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SEVENTIETH REPORT OF THE STATE GEOLOGIST

ACTIVITIES OF THE CALIFORNIA DIVISION OF MINES AND GEOLOGY JULY 1, 1976, THROUGH JUNE 30, 1977

Thomas E. Gay, State Geologist
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FOREWORD

As California's population and economy continue to grow and as people continue to move into the major metropolitan areas, geological knowledge has become increasingly important in maintaining an acceptable environment. In many urban areas suitable building sites are scarce and houses are being constructed on hillsides and lowland areas subject to unstable soil and bedrock conditions in areas adjacent to active faults, and in other geologically hazardous areas. With the scarcity of suitable building sites, increasing development costs, and potential major geologic hazards, the Division's earth science technology projects have developed criteria for guiding urban development.

The California Division of Mines and Geology has active statewide and local programs for reduction, mitigation, and prediction of seismic and other geologic hazards, to minimize loss of life and damage to property. These activities include the Fault Evaluation and Zoning (Alquist-Priolo) program, the Earthquake Hazard Reduction program, the Strong Motion Instrumentation Program, the Site Evaluation and Review program, and the State Geologic Map project, including the recently completed Fault Map of California.

The Division has continued its historical mission to provide information useful to the mineral industry. An important factor not often recognized by the lay public is the long lead time between discovery and development of a mineral resource. The identification of mineral resources before urban development has precluded resource development is a vital program mandated by the Surface Mining and Reclamation Act of 1975.

The Division continually works to encourage the recognition and consideration of fundamental geologic knowledge that bears on the economic well-being and safety of the citizens of California.

HIGHLIGHTS OF FISCAL YEAR 1976 - 1977

Fiscal year 1976-1977 marked the first full year that the Division operated with policy guidance provided by the new State Mining and Geology Board appointed by the Governor on May 22, 1976. The Board's immediate concern was to establish policy and guidelines for the Surface Mining and Reclamation Act, which was adopted on December 21, 1976.

A significant organizational change was made in the Department of Conservation early in 1977 when the Division of Forestry became a separate department. The Director of the Department of Conservation became the Director of the Department of Forestry. Priscilla C. Grew, the State Mining and Geology Board chairman, was appointed Director of the Department of Conservation. The Division of Mines and Geology became the largest division in the Department of Conservation. Effective May 1, 1977, Thomas E. Gay, Jr., was appointed State Geologist.

In January 1977 the Strong Motion Instrumentation Advisory Board and the Geologic Hazards Technical Advisory Committee functions were delegated to the Seismic Safety Commission.

The Division implemented the provisions of the Surface Mining and Reclamation Act (SMARA). In preparation for land classification under SMARA, the Division completed a major aggregate study of the greater Los Angeles area, and began a similar aggregate study of the San Francisco Bay area counties. The aggregate studies were funded by and conducted in cooperation with the U. S. Bureau of Mines (USBM).

The Division participated in evaluation of the seismic potential at the proposed Auburn damsite, a U.S. Bureau of Reclamation water storage facility in the Central Valley Project. Other Division activities included investigation of the Humboldt nuclear reactor site; detailed mapping in portions of the San Andreas, Santa Monica, Rose Canyon, and San Gabriel fault zones; geologic hazard investigation reports in Orange, Ventura, Los Angeles, San Bernardino, Marin, Sonoma, and Santa Clara Counties; timber-harvest plan review, and timberland soil erosion studies; compilation of geologic map of California (1:750,000); participation on Geothermal Task Force, and Coastal Erosion Task Force; microearthquake instrumentation program for Alquist/Priolo zonation and hazard identification; technical reviews of Environmental Impact Reports (EIRs) and hospital site reports.

DIVISION PROGRAMS

The Division's programs provide technical data to assist public agencies and the private sector in the wise and safe use of the earth's crust, its terrain, and its mineral resources. The overall objective is to identify and provide timely delineation of geologic hazards and to identify, delineate, and assist in the ultimate utilization of deposits of minerals, both onshore and offshore, consistent with wise conservation practices.

Potentially hazardous geologic conditions must be identified prior to land development in order to protect the public from possible economic loss and injury. These hazards include landsliding, ground rupturing caused by fault movements, ground shaking caused by earthquakes, tsunamis (seismic sea waves), volcanic eruptions, land subsidence, expansive soils, and erosion. Deposits of mineral raw materials must be identified and delineated so action can be taken to prevent their loss to urban encroachment.

The following programs deal with environmental concerns and economic mineral resources.

I. GEOLOGIC HAZARDS PROGRAM

Division activities directly concerned with geologic hazards are: (1) active fault evaluation and delineation as required by the Alquist-Priolo Special Studies Zones Act; (2) cooperative studies with the U.S. Geological Survey under its Earthquake Hazard Reduction Program; (3) cooperative agreements with local government to identify geologic hazards; (4) installation, maintenance, and operation of strong motion instruments to provide data for earthquake resistant building design; (5) geologic/seismic reviews of reports on hospital, power plant, and dam sites, and Environmental Impact Reports; and (6) geology and forest management.

1. Active Fault Evaluation

The Division of Mines and Geology active fault mapping program (Alquist-Priolo Special Studies Zone Act of 1972) was established in Chapter 7.5, Public Resources Code. The objective of the law is to provide for the public safety from surface rupture in hazardous fault zones by restricting construction astride active fault breaks. Under the Act, the State Geologist delineates special studies zones about one quarter mile wide along potentially hazardous faults, starting with the State's four major faults: the San Andreas, Calaveras, Hayward, and San Jacinto faults. Under policies generated by the State Mining and Geology Board, local governments permit certain development projects in the special studies zones only after geologic study shows building sites to be free of hazardous faults.

During 1973, the first year of the program, special studies zones along the four major faults were delineated on 175 7 1/2-minute quadrangle maps. After public review, these maps were officially issued on 1 July 1974. During 1974-75, faults in an additional 76 quadrangles were zoned and reviewed, for official release 1 January 1976; also, 5 of the 1974 maps were revised for reissue.

The 1974-75 fault-zoning program had significantly different emphasis from the first year's, because it had to deal with faults about which comparatively little is known, geologically. The burden of making geological determinations whether particular faults are "sufficiently active" to constitute potential hazard fell on the Division -- this had been no problem for the four major faults, which were well known to have had recent and repeated movements.

The planned active fault mapping and evaluation program will evaluate about 3,000 miles of potentially active fault breaks, during the ten years 1976-86 (see figure 1). In 1986-87, the evaluation and zoning will be complete, but maintenance and updating activities will continue. The evaluation of the area designated for 1976 was started in March 1976 and completed in March 1977. More than thirty potentially active faults were evaluated and the data were summarized in fault evaluation reports now filed in the San Francisco District office. Preliminary review maps of the Special Studies Zones are near completion. Special Publication 47, Active fault mapping and evaluation program, ten year program to implement Alquist-Priolo Special Studies zones Act, is available for $2.00 plus tax.

2. Cooperative Studies with the U.S. Geological Survey

The U.S. Geological Survey provided funds for geological studies by the Division along the San Andreas fault in Los Angeles County, in the northwestern two-thirds of the San Gabriel fault zone in Los Angeles and Ventura Counties, along the Santa Monica-Hollywood-Raymond Hill fault in Los Angeles County, and for studies of surface faulting and liquefaction as potential earthquake hazards in urban San Diego, San Diego County. These studies are part of the U.S. Geological Survey's Earthquake Hazard Reduction Program. Beginning in 1972-73 and continuing through 1976-77, the Division participated in the program. During 1976-77, the grant/contracts amount was $136,055. Because of the change in the Federal fiscal year, the funding for most contracts covered the period July 1976 to October 1977.

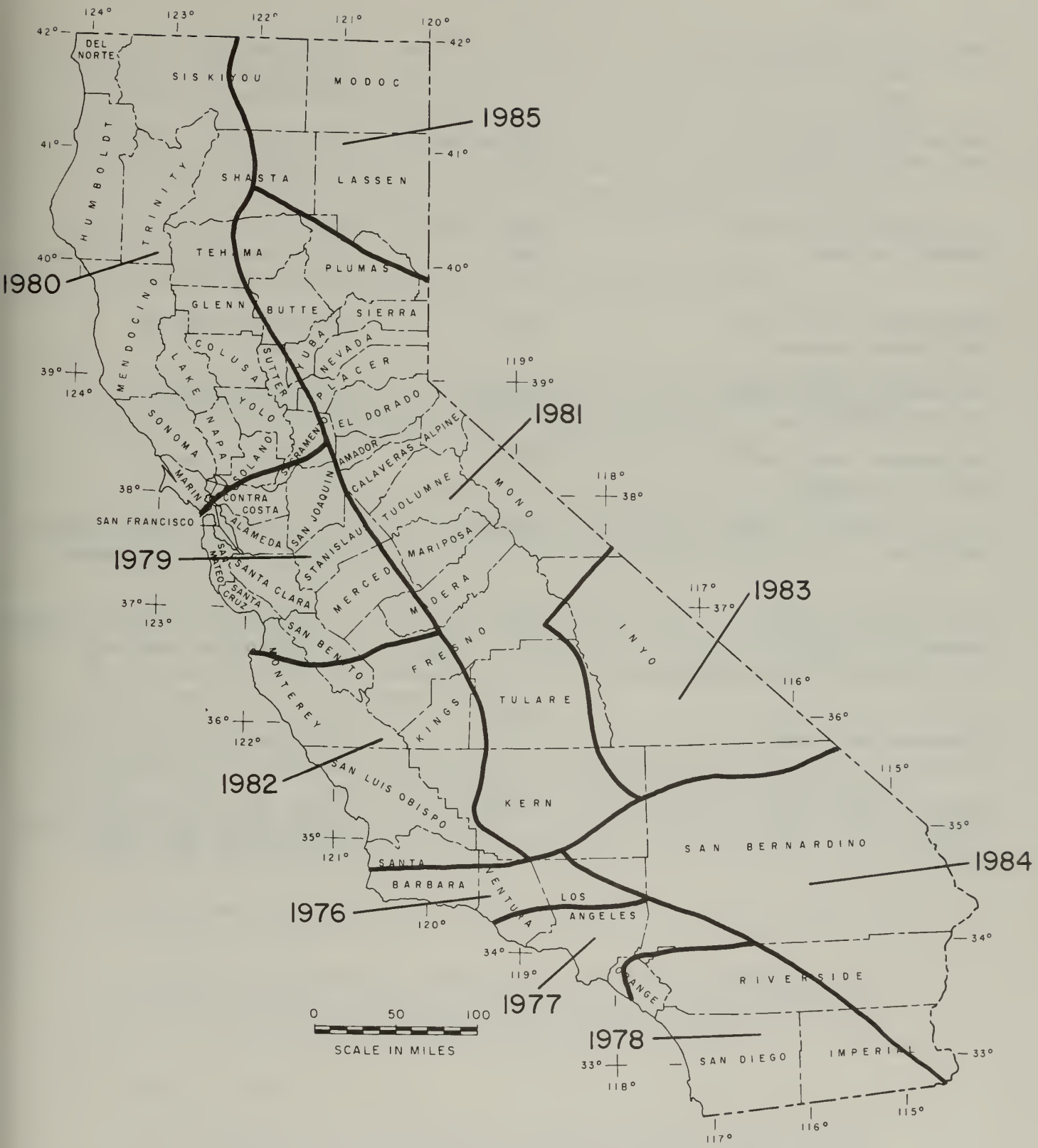


Figure 1. Fault evaluation Plan (Alquist-Priolo Special Studies Zones Act) showing work plan priorities.

Specific Project Status and Staff Participation

Project	Staff	Status
Santa Monica-Raymond Hill fault zone	Hill, Sprotte	In progress. Final Technical Report to USGS to be completed October 1977.
San Andreas fault zone: Leona Valley segment	Kahle, Beeby, Smith	Preparing for publication; Open File Report 77-2 LA released.
San Andreas fault zone: Palmdale segment	Kahle, Beeby, Smith	Final Technical Report to USGS completed: Open File Report 76-6 LA released.
San Andreas fault zone: Lake Hughes segment	Beeby	Fault trace map in progress.
San Andreas fault zone: Valyermo segment	Barrows	Fault trace map in progress.
San Andreas fault zone: Quail Lake segment	Kahle	Fault trace map in progress.
Surface faulting in Urban San Diego	Kennedy	In progress. Final Technical Report to USGS to be completed October 1977.
Northwestern 2/3 San Gabriel Fault Zone, Los Angeles and Ventura Cos.	Weber	In progress. Technical Report to USGS to be completed October 1977
Elsinore fault zone, Riverside Co., north portion	Weber	Final Technical Report to USGS completed; Open File Report 77-4 LA released.
Elsinore fault zone, Riverside Co., south portion	Kennedy	Final Technical Report to USGS completed; submitted for publication processing.

3. Cooperative Studies with County and Local Governments

The Division conducts a number of geological studies in cooperation with local government and other State agencies to provide technical information about actual or potential areas of geologic hazard and mineral resources. Some of the studies demonstrate the need for, and the usefulness of, geology to local government planning, building, and public works agencies. Cooperative activities are funded jointly by the Division and the cooperating agency under various arrangements, the nature of which depends upon the availability of funds and personnel, the relative urgency of the project to the State and to the cooperating agencies, and other factors.

The status of individual county projects are as follows:

a) Los Angeles County

The Department of the County Engineer and the Los Angeles County Flood Control District continued to provide funds to accelerate the Division's geologic studies in the County. Field mapping in progress: North portion of Pasadena quadrangle; and southeast quarter Newhall quadrangle.

Reports in preparation: Juniper Hills quadrangle area; south half Mt. Baldy and southwest quarter Calabasas and southeast quarter Thousand Oaks quadrangles; south half of Mint Canyon quadrangle; parts of Oat Mountain quadrangle; and northeast quarter Newhall quadrangle.

Reports published: Map Sheet 27, "Geology of the northeast part of the Palos Verdes Hills, Los Angeles County, California" by George B. Cleveland. Map Sheet 28, "Geology of the west central part of the Mt. Wilson 7 1/2 minute quadrangle, San Gabriel Mountains, Los Angeles County, California" by Richard B. Saul.

The Los Angeles Department of the County Engineer also continued to provide funds to accelerate the Division's cooperative fault hazards study with the USGS (Earthquake Hazard Reduction Program) in the San Andreas fault zone in the northern portion of the County. Fault maps of the Quail Lake, Lake Hughes, and Valyermo segments of the San Andreas fault were nearly completed at year's end.

Field mapping in progress: Quail Lake, Lake Hughes, and Valyermo of the San Andreas fault.

Reports in preparation: Leona Valley and Palmdale segments of the San Andreas fault (OFR 77-2 LA) by James E. Kahle, Drew P. Smith and David J. Beeby; Palmdale segment of the San Andreas fault (OFR 76-6 LA) by Allan G. Barrows, James E. Kahle, and David J. Beeby.

b) Orange County

The Orange County Environmental Management Agency (Department of Building and Safety, Road Department, and Orange County Flood Control District) continued to provide funds to accelerate the Division's

geologic studies in the County.

Field mapping in progress: North half El Toro quadrangle; southwest quarter Santiago Peak quadrangle.

Reports in preparation: La Habra, Yorba Linda, and Prado Dam quadrangles.

Reports being processed for publication: Environmental geology of Orange County; Recency of faulting in Orange County, California.

Published Reports: Special Report 126, "Geology and engineering geologic aspects of the south half of the Tustin quadrangle, Orange County, California" by R. V. Miller and S. S. Tan.

Special Report 127, "Geology and engineering geologic aspects of the Laguna Beach quadrangle, Orange County, California" by S. S. Tan and W. J. Edgington.

Reports Open Filed: Recency of faulting in Orange County, California, OFR 77-3 LA, by R. V. Miller, Siang S. Tan, and Paul K. Morton.

c) San Bernardino County

No funds were provided by the County for continued work, but a report on the geology, geophysics, and seismology of the southwestern part of the County, Special Report 113, "Geologic hazards in southwestern San Bernardino County, California" by Donald L. Fife, Donald A. Rogers, Gordon W. Chase, Roger H. Chapman, and Edward C. Sprotte with maps by Douglas M. Morton of the U.S. Geological Survey, was released.

d) City of San Diego

A report was published on the results of the San Diego cooperative study, Bulletin 200, "Geology of the San Diego Metropolitan area, California, Del Mar, La Jolla, Point Loma, La Mesa, Poway, and SW 1/4 Escondido 7 1/2 minute quadrangle" by Michael P. Kennedy and Gary L. Peterson. No funds were provided for continued work in the City, but a second report, "Geology of National City, Imperial Beach, and Otay Mesa quadrangles, southern San Diego Metropolitan area, California" by Michael P. Kennedy and Siang S. Tan, was released as Map Sheet 29.

e) Marin County

The final report and maps for the Geronimo Valley, Corte Madera, Tiburon Peninsula, San Rafael, and Novato areas were completed and delivered to the county.

The Division entered into a new agreement with Marin County to map and provide a report on the geologic hazards in the Inverness, Olema, Tomales Bay, and Bolinas areas of western Marin County. At year's end the field work on this project was complete and the preliminary report was being reviewed in Division Headquarters.

f) Sonoma County

Field work, maps, and the preliminary report for the slope stability study of the Mark West Springs-Porter Creek area were completed. The maps and report were being reviewed in Division Headquarters. Preliminary talks concerning a continuation of the Division's work in the county were underway at year's end.

Reports in preparation: Final report on the Mark West Springs-Porter Creek area.

Reports being processed for publication: Geology for Planning in Sonoma County, Special Report 120.

g) Santa Clara County

A contract was negotiated with Santa Clara County for a geologic hazard study in a 14-square-mile area along the east side of the Santa Clara Valley. Work is scheduled to start early in fiscal year 1977-78.

Specific Project Status and Staff Participation

Project	Staff	Status
Juniper Hills quadrangle	Barrows	First draft completed 1974-75; recessed during 1975-76 for other San Andreas area. Revised report nearly complete as of June 1978.
Pasadena quadrangle	Smith	Mapping completed.
Southwest San Bernardino County	Fife, Sprotte, Chase, Chapman (and others)	Special Report 113 released.
Southwest quarter Mint Canyon quadrangle	Saul	Revising report of SW/4 and combining with SE/4 to make one report on south half.
Southeast quarter Mine Canyon quadrangle	Saul	See above.
National City, Imperial Beach, Otay Mesa quadrangles	Kennedy, Tan	Map Sheet 29 released.
City of San Diego (six quadrangles)	Kennedy	Bulletin 200 released.
South half Mt. Baldy and southwest quarter Glendora quadrangles	Streitz	Report being revised after Headquarters review.
South half Tustin quadrangle	Miller, Tan	Special Report 126 released.
West Central Mt. Wilson quadrangle	Saul	Map Sheet 28 released.
Laguna Beach quadrangle	Tan, Edgington*	Special Report 127 released.
Calabasas and Thousand Oaks quadrangles	Weber	Report revised after Headquarters review; being prepared for open file release (OFR 77-7 LA).
Southeast quarter Oat Mt. quadrangle	Saul	Report revised after District review; submitted for publication processing.
Southwest quarter Oat Mt. quadrangle	Evans	In publication processing. Interrupted by higher priorities.

La Habra, Yorba Linda, and Prado Dam quadrangles	Tan, Miller	First draft completed; in District review.
Orange County fault study	Miller, Tan	Report revised after District review of first draft. Open File Report 77-3 LA released. Submitted for publication processing.
Ventura County Seismic Hazards study	Weber, Sprotte, Kiessling, Cleveland, Johnson* Sherburne	Submitted for publication; Open File Report 76-5 LA released.
Northeast part Palos Verdes Hills	Cleveland	Map Sheet 27 released.
Northeast quarter Newhall quadrangle	Smith	Mapping completed; first draft completed; in District review.
Southeast quarter Newhall quadrangle	Saul	Base map prepared; air photo work.
North half El Toro quadrangle	Tan, Miller, Fife	Mapping completed; first draft nearly completed.
Southwest quarter Santiago PK quadrangle	Miller, Morton	Mapping completed; first draft nearly completed.
Haiwee Reservoir and Keeler quadrangles	Stinson	Review in process.
Sonoma County; Mark West Springs	Armstrong	Field work completed, final report in preparation.
Marin County; Olema, Inverness, Tomales Bay, Pt. Reyes Station and Bolinas areas	Wagner	Field investigations completed, maps and report in review.
Marin County; Pt. Reyes Station, San Geronimo Valley, Corte Madera and Tiburon Peninsula	Rice, T. Smith	Maps and final report delivered to County; Pt. Reyes Station portion to be finalized next year.
Santa Clara County; Mt. Diablo foothills	Armstrong, Wagner	Contract approved by County, work to start first of next fiscal year.

Geophysical support was provided for the Sonoma County, Mark West Springs project.	Chapman, Chase, Campbell	Completed.
Hollister-San Felipe quadrangles	Rogers	Review in progress.
North half Confidence Hills quadrangle	Troxel*, Wright*	In publication processing; Map Sheet 34.
Sonoma County; County-wide study to assist in preparation of general plan elements.	Huffman, Armstrong	To be published as Special Report 120.

*Geologist no longer with the Division.

4. Strong Motion Instrumentation

One of the primary problems confronting structural engineers in their efforts to design earthquake resistant structures is the lack of knowledge regarding the force of ground motion and the deformation induced in structures and facilities by earthquake generated ground motion. In late 1971, Chapter 8 of Division 2 of the Public Resources Code (SB 1374) was signed into law to establish and monitor a Strong Motion Instrumentation Program (SMIP). The California Division of Mines and Geology was designated as the responsible managing agency.

The Division is installing, maintaining, and monitoring a network of strong motion instruments to advance knowledge of the nature of strong earthquake motion for earthquake building design. This activity is supported by a special fund derived from a fee on all construction permits issued by cities and counties.

The SMIP objective is to obtain statewide detailed records of the response of rock and soil units and of engineered structures to ground motion generated by earthquakes. The accelerometer, an instrument that measures the force-generating properties of seismic waves, is used to record these data.

A new program has recently been implemented to record the response characteristics of subsurface materials to motion generated by earthquakes. Knowledge of underground responses are important for two basic reasons: (1) direct application to the design of deeply founded and underground structures, and (2) further understanding of how motion responses vary as earthquake energy is propagated upward from the underlying bedrock to the surface. An understanding of underground responses will enable designers of future structures to predict how the surface at a certain site will react to an earthquake.

During fiscal year 1976-77 the Strong Motion Instrumentation activity, operated by the Office of Strong Motion Studies from Sacramento and San Bernardino, completed five years of operation.

On January 1, 1977, the Strong Motion Instrumentation Committee of the Seismic Safety Commission assumed guidance of the activity which previously had been provided by the Strong Motion Instrumentation Program Advisory Board. Recommendation by the Board and its successor committee included provisional approval of the instrumentation of fourteen transportation facility structures, two additional buildings, and thirteen free-field stations which included one down-hole array.

Thirty-one free-field installations including two down-hole arrays, instrumentation of sixteen buildings, and the instrumentation of four dams with thirty-six data channels were added this year. In addition, upgrading of all existing stations continued. A survey disclosed a variety of minor problems with a number of free-field sites which are to be corrected during this program phase. A number of serious problems, mostly in inter-connecting cabling, were found in instruments located at dam

installations. Correction of these deficiencies have been assigned the highest priority.

During fiscal year 1976-77, the operations and staffing of the program reached a complexity and size which required consolidation into an independent unit of the Division. The unit was entitled the Office of Strong Motion Studies and was organized along functional lines (figure 2). The activity was budgeted at $623,578 for the year. Actual expenses totaled $621,176 with revenues of approximately $988,000, resulting in a net gain to the Strong Motion Instrumentation Fund of approximately $367,000.

5. Geologic/Seismic Reviews

a) Hospital Sites

The Division continued to review reports under the provisions of the Hospital Safety Act (Health and Safety Code) which became effective March 7, 1973. This Act required that new hospitals, including additions, reconstructions, and out-patient facilities, be functional during and after an earthquake or other natural disaster. During fiscal year 1976-77 CDMG provided the review of ninety new and supplemental geologic/seismic reports for hospital sites which were submitted by consulting engineering geology firms to the State Office of Architecture and Construction (OAC).

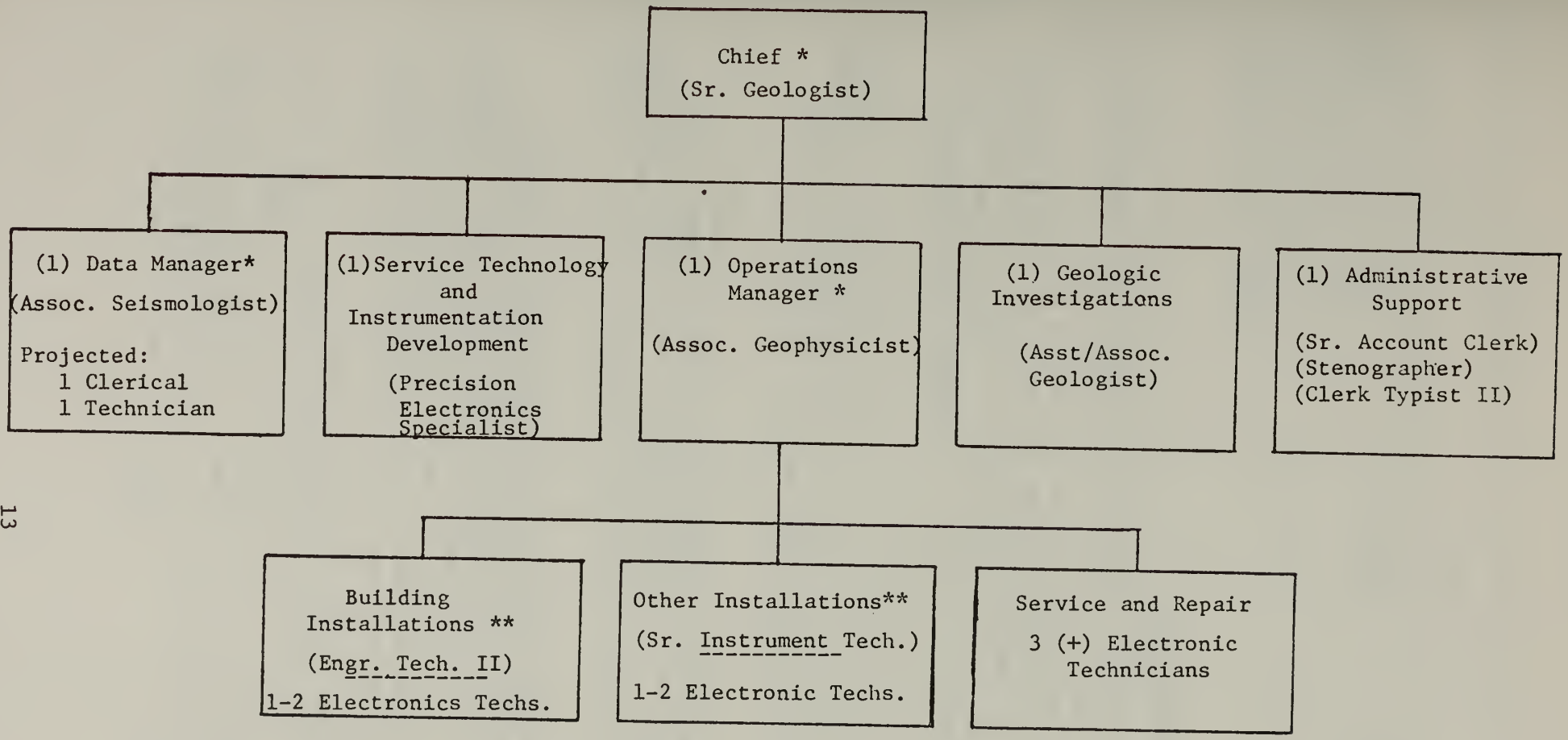
A subcommittee of the Seismic Safety Commission investigated the implementation of the Hospital Safety Act and recommended a modification of CDMG's geologic/seismic review guidelines for increased clarity and efficiency. At the Seismic Safety Commission meeting, the Division recomended that existing hospital sites having alterations or additions which prolong the life of the old structures have adequate geologic reports.

b) Nuclear and Fossil Fuel Power Plant Sites

Preliminary discussions between CDMG and the Energy Resource Conservation and Development Commission (ERCDC) in fiscal year 1976-76 resulted in a decision to have CDMG provide geologic/seismic information on nuclear and fossil fuel power facilities which come under the jurisdiction of ERCDC. A contract for three positions was negotiated with ERCDC and toward the end of fiscal year 1976-77, the Division devoted much time to the review of the Sundesert Nuclear Project. Only projects under the Notice of Intent (NOI) will be reviewed. It is expected that this activity will be continued as a regular service to ERCDC.

The Division has developed a more active relationship with the Federal Nuclear Regulatory Commission in the review of nuclear power plant projects in California. Considerable time was spent in the field and in office review by Division staff tc provide analyses of geologic and seismic hazards. Division personnel are now involved at all levels of field review of nuclear sites and actively participate in decision-making processes.

OFFICE OF STRONG MOTION STUDIES



(1) In addition, all first line positions will serve as advisory staff to the Chief for program planning and data evaluation.

* Full supervisory positions

** "Lead-man" positions

APPROVED:

Thomas E. Gay, Jr.
State Geologist

Effective 4/18/77; staffing projected to FY 1977-78

Figure 2. Office of Strong Motion Studies, organizational chart.

Specific Project Status and Staff Participation

Project	Staff	Status
Nuclear and fossil fuel power plant site reviews	Morton, Martin, Kilbourne	Provided testimony at hearings. Field investigations; memorandums completed. Continuing site review and anlysis of technical reports with federal agency staff.

c) Oroville and Auburn Dam Sites

As a result of the Oroville earthquake occurring in the Oroville Dam area and the resultant public concern over the seismic safety of the proposed U.S. Bureau of Reclamation Auburn dam, located in the same Foothill shear zone, the Division initiated two projects to assess geologic and seismic hazards. The Oroville-Bangor mapping project was a cooperative effort with the Department of Water Resources. The Foothill Shear Zone project was an investigation to determine the potential for geologic and seismic hazards in the foothill area south of Oroville, including the Auburn area.

Mapping for the Oroville-Bangor project, which investigated the geology from Oroville dam northward to the southern end of the surface ruptures along the Cleveland Hill fault zone, was completed. The report is to be open-filed in the fiscal year 1977-78.

The Foothill Shear Zone project involved geologic reconnaissance mapping of the area between the southern boundary of the Oroville-Bangor project and the City of Auburn in order to provide data on faults and on the age and magnitude of past seismic activity. The Auburn dam project has resulted in a large increase in geologic and seismic information. The report has been submitted to Headquarters for review.

Considerable input was provided by Division personnel to clarify geologic and seismic considerations in the safety analysis of the proposed Auburn dam. The Divisions's involvement was particularly timely because of continuing studies of the Sierra Foothill fault zone following the Oroville earthquake. In addition to studying the geology and seismology along the Foothill fault, the Division was asked to review the reports and trenching conducted by consultants for the USBR Auburn dam site.

Specific Project Status and Staff Participation

Project	Staff	Status
Oroville-Bangor Mapping	Aune	Office report completed; to be open-file.
Auburn Dam site review	Rice, Borchardt	Work in progress.

d) Environmental Impact Reports

The Division has continued to review Environmental Impact Reports (EIRs) in 1976-77; approximately 234 reports were processed by the staff. The EIRs reviewed covered a variety of projects, including sites for power plant facilities, petro-chemical facilities, subdivisions, school sites, mining activity, and dam sites. All projects are reviewed using the Division's EIR guideline (CDMG Note #46). The problems of earthquake shaking, fault rupture, landsliding, erosion, expansive soil, tsunami, subsidence, volcanic eruption, mineral resource conservation, and mined-land reclamation are considered in the review.

The most significant projects, which involved the review of many supplemental reports and attendance by the staff at numerous meetings, were the Warm Springs dam, Marysville dam, Liquefied Natural Gas facilities, SOHIO project, PG&E Oakland Power Plant, and New Melones Transmission Line project.

During fiscal year 1976-1977, 234 environmental impact reports were reviewed, or are in process of review by the staff.

6. Geology and Forest Management

Two staff members have been assigned full-time to the Division of Forestry for geologic study associated with the control of soil erosion during timber harvesting.

Specific Project Status and Staff Participation

Project	Staff	Status
Division of Forestry Timber Harvest Plan Review	Huffman, Ristau Amimoto, Bacon, Streitz, Hauge	Two full-time assignments. Special Redwood Creek rehabilitation study completed.

II. SEISMOLOGICAL/GEOPHYSICAL PROGRAM

Division activities under the Seismological Geophysical Program are: (1) Microearthquake studies; (2) Earthquake catalog; (3) Earthquake monitoring; (4) Crustal movement investigations; (5) Earthquake prediction, and (6) Geophysical surveys.

1. Microearthquake Studies

The Division acquired eight portable earthquake recording systems which can detect and locate microseismic activity. These instruments are being deployed for various studies pertinent to the assessment of seismic risk, including: (a) identification of faults that are seismically active; (b) support of the Alquist-Priolo Act by refining zones of active faulting; and (c) the study of damaging earthquake aftershocks to determine the seismic/geologic relationships of the earthquake process.

From August to November, 1976, these instruments were initially deployed along the Foothill fault system in western Placer County in conjunction with Division studies of that fault system. Significantly, twenty-two microearthquakes were located in two distinct areas within the study area during the brief period of operation.

From March to July, 1977, the instruments were in operation along the Cucamonga fault near Etiwanda in western San Bernardino County as part of a Division study to further define fault hazards in this rapidly urbanizing area. Numerous seismic events recorded during the period of operation confirm that the area is currently seismically active; detailed analysis of the records is in progress. Routine instrumental operations were accomplished by utilizing the services of geotechnical students at California Polytechnic University, Pomona.

2. Earthquake Catalog

Efforts continued to refine and improve the utility of the Earthquake Catalog of California. Private consultants and public agencies, both state and federal, have expressed great interest in obtaining and utilizing the Earthquake Catalog. This computerized system, in addition to providing for file generation and maintenance of earthquake records, permits selection of records according to magnitude, date of occurrence, geographic coordinates, and other parameters. Earthquake recurrence studies can now be made within any desired area. The size of any search area can be computed, and recurrence coefficients can be determined by least squares and maximum likelihood techniques. The catalog will be made available to the public during fiscal year 1977-78 on magnetic tape, or as published listings and epicenter maps.

The first published product of the Earthquake Catalog, covering the first thirty-two years of this century, is in press. Progress on the Earthquake Catalog project was reported by CDMG seismologists to professional meetings of the American Geophysical Union in December 1976 and the Seismological Society of America in April 1977, and was published (see figure 3) in CALIFORNIA GEOLOGY (June 1977). A proposal to research California earthquakes which occurred before 1900 was submitted to the U.S. Geological Survey. The proposal was accepted and will be funded for one year starting in October 1977.

A byproduct of the catalog data was a computation of seismic strain release in California, which indicated that the last twenty years has been the period of lowest strain release this century.

3. Earthquake Monitoring

The Division continues to monitor earthquake activity, using two seismographic recorders which are in the lobby of the Resources Building. Two different signals, one from northern and one from central California, are telemetered to these recorders. A third recorder is being ordered to obtain signals from southern California, thus assuring complete statewide coverage. This program will help the Division in its activities

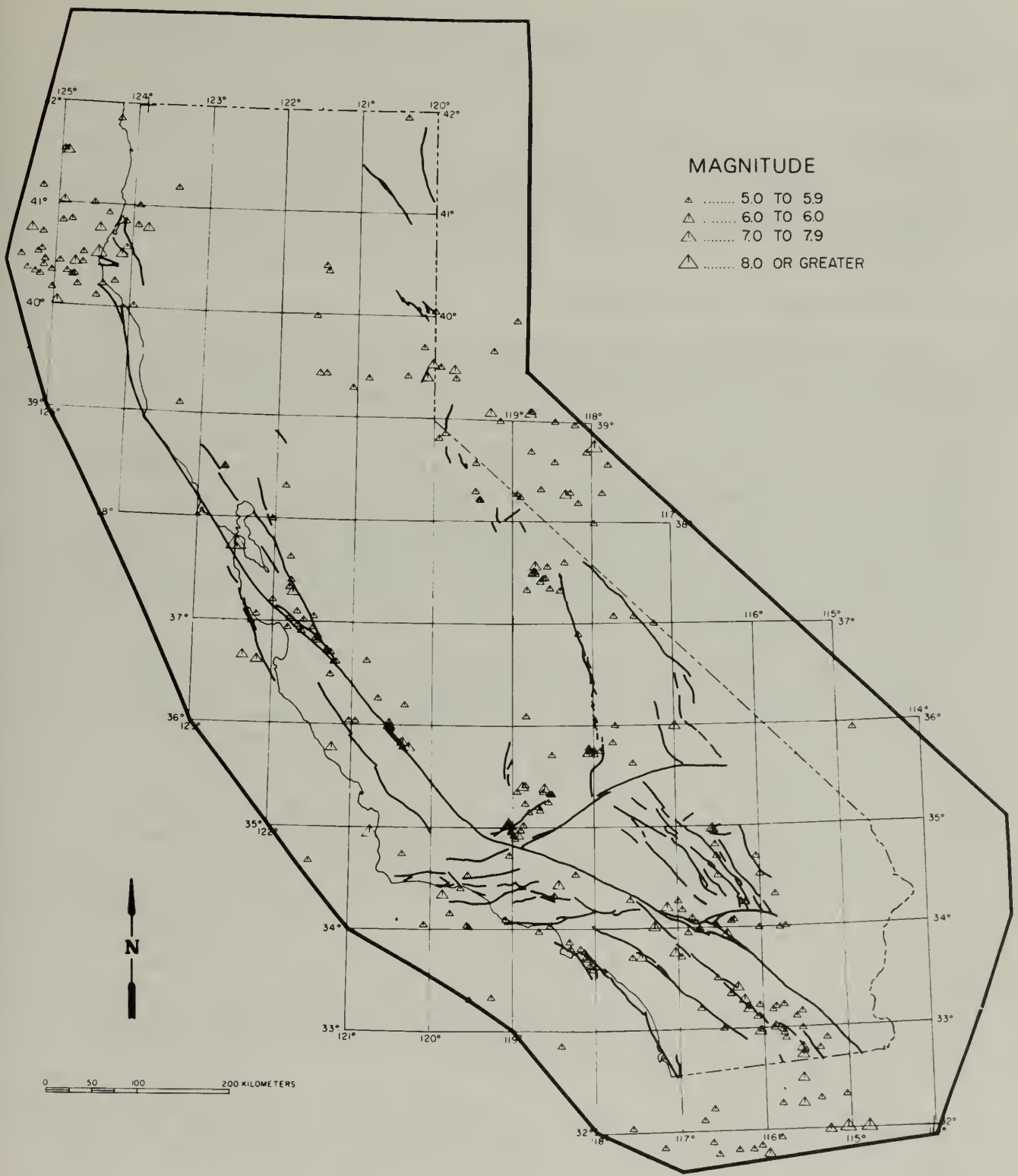


Figure 3. Epicenter map for California (1900-1976).

relating to earthquake prediction, post-earthquake aftershock studies, and clearinghouse functions, and will assist in deployment of strong motion instruments.

Under a continuing agreement with the Seismological Laboratory at California Institute of Technology, the Division provides funds in connection with the recording and study of earthquakes in California. The California Institute of Technology provides prompt notification by telephone of the location of all earthquakes greater than Richter magnitude 4.5 in southern California.

4. Crustal Movement Investigations

The measurement of crustal movements occurring along major faults is a significant part of the Division's activity. These data are useful in determining precise locations of faults and in assessing fault activity. To assess continuing horizontal deformation along the San Andreas fault system, remeasurements of selected Geodimeter lines were completed in two areas: (1) the seismically active Parkfield-Cholame Valley fault segment in eastern Monterey and San Luis Obispo Counties; and (2) the Palmdale "bulge" (ground uplift between Palmdale and San Bernardino in southern California). No significant changes from established trends were indicated in either area. The number of measurements completed during the year was significantly reduced to provide funding for a cooperative releveling program to assess vertical movements in the Palmdale "bulge."

Responding to public concern over the Palmdale "bulge" in southern California, and to the "prediction" by Dr. James Whitcomb, California Institute of Technology, of a moderate earthquake in the same general region, the Division and the California Division of Water Resources entered into cooperative cost-sharing agreements with the County of Los Angeles for releveling. Combined with other leveling by Los Angeles County and the National Geodetic Survey, a total of nearly 350 miles was releveled, providing a timely measure of movements which had occurred since the previous releveling three years earlier. The results were significant, indicating that a major deflation has occurred over a large portion of the uplifted region. At Palmdale this decrease in elevation amounted to -17 centimeters (cm), or about 50% of the uplift occurring since 1959; near Mojave an even greater total subsidence of -24 cm was indicated. At the end of fiscal year 1976-77, plans were being formulated for a comprehensive federally-funded releveling in southern California to begin early in 1978. An article relating to the uplift was published in the August 1976 issue of CALIFORNIA GEOLOGY.

The analysis of leveling data in the northern Sierra Nevada showed evidence of possible vertical movement associated with the Bear Mountain fault zone at Auburn, resulting in efforts to schedule approximately 100 km of releveling in the Auburn area as part of the Division's review of the controversial U.S. Bureau of Reclamation Auburn dam site. This study included an analysis of historic leveling by the National Geodetic Survey between Roseville and Reno, 1976 releveling by CDMG across the Melones fault in Placer County, and historic seismicity of the northern Sierra Nevada. The results were discussed in the March 1977 issue of CALIFORNIA GEOLOGY.

A cooperative cost-sharing agreement was executed with the cities of Long Beach and Signal Hill to fund biannual survey measurements across the Newport-Inglewood fault near Signal Hill. The initial set of reobservations were completed by staff of the City of Long Beach.

As part of a Division study of the Cucamonga fault, a geodetic network was established near Etiwanda to monitor possible fault movements. Horizontal displacements will be monitored using the Division's tellurometer system, and vertical displacements will be determined by precise leveling being conducted under an agreement with the San Bernardino County Surveyor.

5. Earthquake Prediction

The Division is using four techniques for earthquake precursor studies: (a) tiltmeter; (b) gravity; (c) telluric currents; and (d) microacoustic emissions.

a) Tiltmeter

The Division's tiltmeter program, which measures tilting of the earth in relation to earthquake activity, was continued in the Parkfield-Cholame Valley region of the San Andreas fault and at Oroville. Instruments in the Parkfield-Cholame Valley were removed for modification and repair before year's end. Aftershocks of the M 5.7 Oroville earthquake of August 1, 1975, continued to occur, but they were of magnitudes less that 4 and were located more than 10 km from the instrument. Preliminary interpretation of the tilt record shows no obvious precursor to any of these aftershocks. The 13°F seasonal variation of temperature in the vault accounts for the major variations in tilting that were observed.

b) Gravity

The gravity technique consists of monitoring a series of gravity stations along the San Andreas fault near Cholame. These stations monitored every three to six months to detect elevation changes that may precede an earthquake.

c) Telluric Currents

The telluric current-self potential method compares telluric current variations to indirectly measure changes in rock resistivities which may precede earthquakes. The Division is currently operating five telluric current arrays along the San Andreas fault. Results to date have indicated an apparent precursory effect prior to a moderate earthquake in January 1975 in the Parkfield area, but subsequent measurements have not shown anomalous readings and no earthquakes have occurred in the array areas.

d) Microacoustic Emissions

The microacoustic survey stations (to detect high frequency emissions which may occur prior to an earthquake) are located at seven sites between

Palmdale and Parkfield along the San Andreas fault. Because the sites extend from the center of the Palmdale "bulge" along the flank to the northwest, the Division has been especially concerned with data interpretation. These results, not yet thoroughly understood, show a general quieting trend of background acoustic emissions beginning in early 1976 and continuing, with minor fluctuations, to the present.

6. Geophysical Surveys

The Division's geophysical surveys resulted in the publication of Bouguer gravity maps, the identification of new metallic and non-metallic mineral deposits, and assistance to the Division's geologic hazard studies.

A gravity map covering the San Jose Sheet (scale 1:250,000) was published; the Needles Gravity Sheet (scale 1:250,000) was in an advanced stage of preparation. The state gravity map at a scale of 1:750,000 was nearly completed. The gravity data shown on the maps are reduced to complete Bouguer anomalies that include terrain and curvature connections to a distance of 166.7 km from each station for an assumed density of 2.67 grams per cubic centimeter for rocks above sea level.

Geophysical field and office support was provided in the form of magnetic surveys, gravity surveys, seismic refraction surveys, and electrical resistivity surveys, for several cooperative investigations. These surveys provided information pertinent to the determination of local bedrock and water table depth, identification of buried faults, variations in the thickness of subsurface strata, and the seismic velocity of local rock units. Cooperative geophysical investigations were undertaken for the studies tabulated in the "geophysical" listing.

The California Division of Mines and Geology and the U.S. Geological Survey recently signed a cooperative agreement to conduct an aeromagnetic survey of a portion of California's coastal area. The aeromagnetic survey will cover an area of about 5000 square miles including part of the continental shelf and adjacent onshore areas from near Santa Cruz on the north to near Point Conception on the south. The survey will tie in with existing onshore aeromagnetic surveys wherever possible.

The aeromagnetic survey will increase knowledge of the coastal and near shore areas in this part of California with respect to geologic structure, distribution of rock types, and mineral resources. First, the magnetic data will aid in the study of major offshore fault zones, including the Hosgri, Palo Colorado-San Gregorio, and the Sur-Nacimiento, yielding information on extent, continuity, and horizontal displacement of the faults. Second, the data will provide valuable information about possible oil and gas reserves in offshore areas such as the Santa Maria basin. Third, the magnetic data will provide information bearing on such problems as the possible presence of an offshore extension of the Point Sal ophiolite complex, and whether this complex is offset by the Hosgri fault. Fourth, information on possible offshore mineral deposits may also be revealed.

The survey will consist of two parts and will be conducted under contract by a firm experienced in aeromagnetic work. The first part, the actual flying, was completed during the summer of 1976. The second part of the survey, compilation of the data, will be completed later this year, and the information will be released to the public in map form by the California Division of Mines and Geology.

Specific Project Status and Staff Participation

Project	Staff	Status
Active Fault Identification	Cramer, Bennett, Chase, Chapman	Cucamonga report in progress; study to continue.
Earthquake Catalog, pre-1932	Toppozada, Higgins, Parke	In progress.
Earthquake Catalog, 1932 onward	Real	Started creating new data file and modifying retrieval program.
Velocity anomaly precursory to Oroville earthquake	Real	Internal report completed.
Tiltmeter program	Bacon, Durrwachter, Sherburne, Toppozada	3 tiltmeters on San Andreas fault; 2 removed for repair and calibration; and 1 in Oroville; results being analyzed.
San Diego (Otay Valley)	Kennedy and others; Chase, Campbell	Annual progress report submitted to USGS.
Santa Monica-Raymond Hill fault zone (USGS Coop)	Hill, Sprotte, Bennett, Chapman, Chase, Real, Sherburne	Annual progress report submitted to USGS. Analysis of historic Geodetic data in progress.
San Andreas fault	Bennett	Continued periodic Geodimeter measurements.
Newport-Inglewood fault	Barrows, Bennett	Conducted survey for cities of Long Beach and Signal Hill.
Melones fault, Placer County	Bennett	Analyzed historic and CDMG leveling data; results published in CALIFORNIA GEOLOGY.

Foothill Shear Zone studies	Taylor	Delay in report due to new information.
Telluric Current-Self Potential	Durrwachter, Bacon	Operating 3 arrays on San Andreas fault central California.
Crustal movement studies near Parkfield, CA	Bacon, Bennett, Chase, Toppozada, Wells	Continued monitoring geophysical data.
Microacoustic survey	Durrwachter, Bacon	Operating 5 stations; Palmdale-Parkfield along San Andreas fault.
Gravity Map of California, Scale 1:250,000	Chapman, Chase, Campbell	Published: San Jose Sheet; In press: Needles Sheet; In preparation: Fresno, Santa Maria, Salton Sea, Mariposa Sheets.
Gravity Map of California, Scale 1:750,000	Chapman, Chase, Campbell	Both halves completed (preliminary) final map in progress.
Aeromagnetic Map of California, Scale 1:750,000	Chase	Index map being prepared for publication; needs updating.
Port Wine Area study	Chapman, Clark, Chesterman	Report in progress.
San Luis - Ortigalita Fault study	Buchholz, Chapman	Report being reviewed.
Bodie Mining District	Chesterman, Gray, Chapman	Report in progress.
Gravity Leveling Study, Parkfield, Palmdale	Chase, Chapman, Real, Campbell	Continued monitoring of selected stations for changes in gravity; evaluation of data.
USGS Coop Aeromagnetic Survey-Offshore California	Chapman	Survey completed; released as USGS open-file.
Kelly Hot Springs Geothermal Investigation	Chapman, Bacon	Completed initial gravity survey.
Ground Water of Western Placer County	Chapman	Report in progress.
Geophysical support was provided for the following cooperative projects:	Chapman, Chase, Campbell	Results of the geophysical studies are, or will be, included in the final report on the projects.

Pasadena-Palmdale (Cooperative with Cal Tech)	Monitoring selected stations for changes in gravity.

III. MINERALS PROGRAM

Division activities under the Minerals Program include: (1) The Surface Mining and Reclamation Act (SMARA); (2) Mineral Commodities Investigations, and (3) Geothermal Resources Studies.

1. Surface Mining and Reclamation Act (SMARA)

a) Classification of Mineral Lands

The 1975 Surface Mining and Reclamation Act places a new emphasis on the mineral resources of the state in that it requires local government to consider such resources as a part of land-use planning. Mineral lands are to be classified by the State Geologist and designated by the State Mining and Geology Board to be of state, regional, or local significance. At the end of fiscal year 1976-77, the Board adopted, for the State Geologist, guidelines for the classification of mineral lands, as well as a general priority guide.

To implement the mineral aspects of the Surface Mining and Reclamation Act of 1975, a short pilot project to study the sand and gravel resources of the Stanislaus River area was initiated at the request of the State Mining and Geology Board. This study is intended to be a model example for classifying similar mineral deposits throughout the state.

b) Mine Reclamation

The Division's major involvement with the mine reclamation aspects of the 1975 Surface Mining and Reclamation Act was in assisting the Mining and Geology Board in the development of state policy for surface mining reclamation practices, compiling data relative to existing mines, and providing technical assistance to local government in matters concerned with the Act. The Board adopted policies which were included in the State Administrative Code under Title 14 Natural Resources, Division 6 Resources Agency, Chapter 8 Mining and Geology, Subchapter 1 State Mining and Geology Board. The Division published the State Policy for Surface Mining and Reclamation Practice as Special Publication 51.

Specific Project Status and Staff Participation

Project	Staff	Status
Surface mine permits/ reclamation plans	Burnett, Bacon, Rapp, Loyd, Stinson, Anderson	Technical Assistance to local government

2. Mineral Commodity Investigations

a) Aggregate

A study of the aggregate resources of the San Francisco Bay Area counties, counties, funded largely by a grant from the USBM, was initiated during fiscal year 1976-77 and work was in progress at the end of the year. USBM awarded a grant of $50,000 for 1975-76 to the Division for support of a research project entitled "Aggregates in the greater Los Angeles area, California." The objective of the project was to gather and analyze data on ownership, operation, production, marketing, extraction, processing, transportation, land use, and environmental considerations from all active aggregate producers and ready-mix plants within a 60± mile radius of the Los Angeles Civic Center. A report on the aggregates industry in the greater Los Angeles area was transmitted to the USBM early in fiscal year 1976-77. The report was released as Open File Report 77-1 LA. At the end of the fiscal year, it had been revised and was being processed for publication.

b) Uranium

The Division is continuing its study to describe all potential uranium mineral localities statewide. Core drilling equipment was acquired to obtain samples for laboratory testing.

c) Chromium

The Sacramento District is continuing to investigate chromium properties as an outgrowth of the study conducted by the San Francisco District during the fiscal year 1976-76.

3. Geothermal Resources Studies

The Division of Mines and Geology, with a number of other agencies (Oil and Gas, Fish and Game, PUC, Energy Commission, Air Resources, DWR, OPR, State Lands, Water Quality, Solid Waste), has been involved since January 1977 in intensive efforts to answer questions posed by Assemblyman Kapiloff's bill on geothermal energy resources in California (Chapter 958, Statutes 1976). Eight public hearings were held and the testimony of leading experts on geothermal energy in California was taken. At the end of the year (June 1977), members of the Task Force began writing the final report to the Governor and Legislature. All aspects of geothermal energy will be covered, from resource assessment to environmental impact and expeditious development.

A project to ascertain the geologic problems involved in the development of geothermal power at The Geysers Geothermal Resources Area located in Sonoma, Lake, and Napa Counties was started during fiscal year 1976-77. Field investigations had been completed and the text and maps were being reviewed at the end of the year.

Specific Project Status and Staff Participation

Project	Staff	Status
Geothermal Activities	Bacon	Studies intermittent; response to Geothermal Resources Board.
Geothermal Task Force	Bacon	Multi-agency study; continuing.
The Geysers	Kistau	Field investigations completed, report in review.

IV. BASIC GEOLOGY PROGRAM

The Division's basic geology activities consist of geochemical analyses, areal geologic mapping and geologic compilation fundamental to mineral resource, engineering geology, and general land-use analyses. The basic objective is to understand and describe the distribution of rock units their physical properties so the State may advise in matters concerning the geology of any part of the State. Among other results, such investigations have assembled most ot the knowledge concerning the location of faults in California.

Currently, constant basic geologic mapping in progress is incidental to environmental geology investigations, but basic geologic mapping per se is not now being conducted by the Division. The mapping listed under the geologic hazards program will serve as "basic" geologic mapping.

The State Fault map, scale 1:750,000, was published in fiscal year 1976-77 and corrections to the watercote copies of the State Geologic Map (scale 1:750,000) were being made as of June 1977. An index and explanation of source data used to compile the State Geologic and Fault Maps, scale 1:750,000, was also in preparation.

A watercote copy of the revised Death Valley Geologic Map Sheet, scale 1:250,000, was being prepared by Williams and Heintz.

The Division of Mines and Geology has participated in the establishment, sustaining support, and advisory guidance of the California Well Sample Repository, which is located on the campus of California State College, Bakersfield. This Repository is the first public facility of its kind in California and fulfills a long recognized need to assemble, process and preserve, catalog, and make available for public use, a collection of rock samples representative of the geologic history, stratigraphic sequences, rock properties, and mineral resources of the State of California.

The Repository is operated by the California State College, Bakersfield, Foundation, with the guidance and support of an Advisory Committee composed of representatives from the petroleum industry, professional scientific societies, institutions of higher education, and state and federal government. The Division is represented on this Advisory Committee, and during fiscal year 1976-77 the Division provided $5,000 for the operation and maintenance of the Repository. Energy and mineral resource development based on investigative studies of rock materials assembled at this Repository will result in manifold benefits to the people of California.

Specific Project Status and Staff Participation

Project	Staff	Status
Subsurface data collection	Sprotte	Data to be included in various projects.
Index to Geologic Maps, 1969-75	Kiessling	Indexing completed; submitted for publication processing.
Death Valley Geologic Map Sheet, scale 1:250,000	Streitz, Stinson	Preparing watercote.
Index and explanation of source data used to compile State Geologic and Fault Maps, scale 1:750,000	Jennings	In preparation.
State Fault Map, Scale 1:750,000	Jennings	Published as California Geologic Data Map Series Map No. 1
State Geologic Map Scale 1:750,000	Jennings	Corrections to watercote being made.

The Division's geochemical section provides support to other Division project activities and independent projects of the geochemical staff. During the year about 420 samples were processed.

Considerable efforts were directed toward developing procedures for the chromite and uranium projects. Existing analytical procedures were improved and new procedures developed. Procedures for clay studies were improved, and various modified apparatus for clay mineral identification by x-ray diffraction were assembled.

Specific Project Status and Staff Participation

Project	Staff	Status
Landslide studies and chemical stabilization.	Borchardt, Lofgren, C. Smith	Work in progress.
Clay mineralogy and engineering properties of soil samples.	Borchardt, Lofgren, Loza	Work in progress.
Physical testing of soil and sediment samples from Auburn Dam Review Project.	Majmundar, Loza	Investigation in progress.
Clay mineralogy determination of soil and sediment samples by x-ray diffraction, from Auburn Dam Review Project.	Majmundar, Loza	Investigation in progress.
Ca:Fe ratio determination in soil and sediment samples.	Majmundar, Borchardt, C. Smith	Procedure for determining calcium and iron have been developed.
Ca:Fe ratio determination in Samples from Auburn Dam Review Project	Majmundar, Borchardt, C. Smith	Calcium and iron were determined by x-ray Fluorescence. Investigation in progress.
Procedure development for Ag, Al, As, Au, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Na, Ni, Pb, Zn.	Majmundar, C. Smith	Atomic absorption spectrophotometric procedures for these elements (at trace concentrations) are improved and new procedures are developed.
Trace elements in stream sediments, Monterey County, California.	Majmundar	Released as Open File Report 77-5 SF.
Arsenic, cadmium, copper, lead, mercury, and zinc in stream sediments from Monterey County, California.	Majmundar	A report of the sub-project (Appendix K) submitted as a part of the public health report, to Governor Brown, by the Project Committee for the Monterey Basin Pilot Monitoring Project.

Chromium in California.	Majmundar, de Rama, Lofgren, C. Smith	Analytical work for this project has been continued and staff reports are being prepared.
Procedure for radiometric equivalent analysis by x-ray spectrometer	Majmundar, Borchardt, C. Smith	Rapid analytical procedures for determining Uranium have been developed by x-ray fluorescence.
Radiometric equivalent analysis of core samples obtained from Lucky Mc Uranium Company, Reno, Nevada.	Majmundar, Borchardt, C. Smith, J. Rapp	Investigation in progress.
Physical testing of soil and sediment samples.	Borchardt, Majmundar, Lofgren	Used physical tests on sedimentary materials (Particle size distribution and atterberg tests); bulk and clay mineralogy determination by x-ray diffraction.
X-ray diffraction analysis of clay minerals.	Majmundar, Borchardt, Lofgren	Work in progress for developing rapid procedures.

V. GEOLOGIC DATA PROGRAM

1. Publications

The Geologic Data program provides information on the geology, mineral resources, and geological hazards of California. The Geologic Data staff publishes and distributes the results of studies made by staff members of the California Division of Mines and Geology and others in the earth sciences professions. This is accomplished through the Division's monthly magazine CALIFORNIA GEOLOGY, special reports, bulletins, map sheets, special publications, and preliminary reports, by letter, by informal leaflets (CDMG Notes), by technical and semitechnical illustrated talks, by public exhibits, and by personal contact.

The publications staff reviewed the technical content of manuscripts, drafted illustrations and maps, edited manuscripts and maps, coordinated printing and lithography, negotiated printing contracts, managed the printing budget, and supervised the distribution of the final printed reports. Revenue from the sale of Division publications during fiscal year 1976-77 was $124,055.

News releases concerning the Division's publications are prepared and distributed to the media. Thousands of inquiries received annually by the Division are answered by supplying copies of the CDMG Notes, CALIFORNIA GEOLOGY, and occasionally by individual letter from a member of the technical staff.

An information and publication sales desk is maintained at each of the District offices. The Division's Museum and Library at the San Francisco District also help to inform the public of the importance of geology to the economy of California.

a) New Publications Released

•Bulletin 199. Basic geology of the Santa Margarita area, San Luis Obispo County, California, by E.W. Hart. $7.50.

The Santa Margarita area of investigation lies astride the Rinconada fault, which divides the area into two distinct geologic and physiographic terranes--the La Panza Range to the east and the Santa Lucia Range to the west.

The principal structures are the Rinconada and "Nacimiento" fault zones and intervening Santa Margarita Syncline.

At least 24 mineral deposits have been prospected in the map area, but only crushed and broken stone and sand and gravel have been produced in significant amounts. The Santa Margarita granite quarry is the principal source of high quality aggregate and riprap in San Luis Obispo County.

•B200. Geology of the San Diego Metropolitan Area, California
Section A. Western San Diego Metropolitan Area. By Michael P. Kennedy.
Section B. Eastern San Diego Metropolitan Area. By Michael P. Kennedy and Gary L. Peterson.

Bulletin 200 describes the geology of the 6 quadrangles in the San Diego Metropolitan Area. The geology of each quadrangle is shown in color on a topographic base at a scale of 1:24,000.

Section A.
Western San Diego Metropolitan Area.

The Del Mar, La Jolla, and Point Loma quadrangles are underlain by sedimentary rocks of Late Cretaceous, Eocene, Pliocene, Pleistocene, and Holocene age that rest with angular unconformity on a Mesozoic metamorphic and plutonic rock basement complex.

Section B.
Eastern San Diego Metropolitan Area.

The geology of the La Mesa, Poway, and SW 1/4 Escondido 7.5-minute quadrangles within the eastern and northeastern San Diego metropolitan

area consists of two principal rock units: 1) An igneous and metamorphic basement complex and 2) a superjacent sedimentary succession of strata.

Seismically the area is quiet; however, it lies within a part of southern California considered to be a region of tectonic activity. Forty-four earthquakes of Richter magnitude between 2.5 and 3.7 (M 2.5 to M3.7) have been recorded by the California Institute of Technology Seismological Laboratory since 1950 that have had epicentral localities within the greater San Diego metropolitan area.

•Special Report 106. Geologic features, Death Valley, California edited by B. W. Troxel and L. A. Wright. $7.00

This collection of papers and maps includes a geologic guide to the Death Valley region. Articles also cover the geology of Spring Mountains (Nevada), Furnace Creek borate area, Zabriskie Point, and the southern Great Basin.

•Special Report 113. Geologic hazards in southwestern San Bernardino County, California. By D. L. Fife, D. A. Rodgers, G. W. Chase, R. H. Chapman, and E. C. Sprotte, 1976. Geologic, fault, and major landslide and slope stability maps by Douglas M. Morton. 40 pages, 22 photos, 13 plates. $15.00.

SR 113 reviews and analyzes the available geologic, geophysical, and seismic data in the Upper Santa Ana Valley region of southwestern San Bernardino County.

Potential geologic hazards are identified and delineated on separate topographic maps, scale 1:48,000. Major topics discussed are (1) geologic and structural setting, (2) landslide and slope stability, (3) groundwater, (4) subsidence, (5) geophysical surveys (6) seismicity, (7) fault movement, (8) ground shaking severity, and (9) liquifaction potential.

•Special Report 126. Geology and engineering geologic aspects of the South Half Tustin Quadrangle, Orange County, California, by R. V. Miller and S. S. Tan. $4.00.

SR 126 provides a basic geologic reference for planning urban development in the south half of the Tustin 7.5' quadrangle. The area lies at the southeastern edge of the Los Angeles basin.

The report consists of a two-part, 28-page text accompanied by a geologic map, scale 1:12,000. The first part of the text describes bedrock units, surficial deposits, and structure of the mapped area. These, in turn, are related to hazardous geologic problems associated with the various units exposed in the area. Slope stability and seismicity are the major concerns.

The second part of the text is a systematic listing of terrain, lithologic, and engineering features of the exposed geologic units plus an evaluation of their potential use.

•Special Report 127. Geology and engineering geologic aspects of the Laguna Beach quadrangle, Orange County, California, by S. S. Tan and W. J. Edginton. $5.00.

The report consists of a two-part, 32-page text accompanied by a geologic map, scale 1:12,000. The first part of the text describes bedrock units, surficial deposits, and structure of the mapped area. These, in turn, are related to hazardous geologic problems associated with the various units exposed in the area. Slope stability and seismisity are the major concerns.

The second part of the text is a systematic listing of terrain, lithologic and engineering features of geologic units, plus an evaluation of their potential use.

SR 127 provides planners, geologists, and engineers with geologic and environmental data pertinent to efficient, safe, and intelligent use of the land and resources in the area which includes the San Joaquin Hills, the City of Laguna Beach, and the eastern portion of the City of Newport Beach.

•Special Report 128. K-Feldspar in Upper Mesozoic Sandstone units near Atascadero, Santa Lucia Range, San Luis Obispo County, California, By E. W. Hart. $1.50.

SR 128 presents data on the K-feldspar content of Upper Mesozoic sandstone units near Atascadero, San Luis Obispo County and examines the systematic variations and use of that data as a crude indicator of stratigraphic position and correlation.

The report also documents the existence of mid-Cretaceous Great Valley-type beds in Paradise Valley, San Luis Obispo County and provides preliminary descriptive data on the Upper Mesozoic stratigraphic and tectonic units that may be of use to other workers in the Santa Lucia Range.

•Special Report 129. Short contributions to California geology. $3.00.

SR 129 is a compilation of recently completed original geologic investigations, which emphasize the great diversity and complexity of geologic problems in California. The articles deal with areas ranging from the northern Klamath Mountains to San Diego, and from the desert to the sea.

The thirteen articles in this report are organized into five sections: Geologic Hazards, Structural Geology, Petrology, Stratigraphy, and Marine Geology.

•Special Publication 42. Fault hazard zones in California. Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps, revised 1977, by E. W. Hart. $1.00.

The complete index of zone maps, a list of cities and counties affected by the zones, the text of the Act, and other pertinent data are contained in the January 1977 revision of Special Publication 42, Fault hazard zones in California

•Special Publication 49. California jade. A collection of reprints. $2.00.

SP 49 describes in detail a few of the best known and most significant occurrences of nephrite and jadeite. The five articles in Special Publication 49 deal with such subjects as the origin, occurrence, petrography, mineralogy, and marketing of California jade.

•Special Publication 50. Colemanite deposits near Kramer Junction, San Bernardino County, California, by J. R. Evans and T. P. Anderson. $1.00.

A re-examination of data on these deposits was made by the California Division of Mines and Geology in early 1976 because of the growing importance of calcium borate ores. The major known deposits of colemanite and ulexite-probertite occur in Death Valley National Monument, and significant deposits occur in the nearby Ryan area. Congress is considering (July 1976) legislation to limit or prohibit mining in the Monument. Therefore deposits outside of the Monument have come under close scrutiny and re-evaluation. To aid interested parties, the California Division of Mines and Geology is publishing information on newly discovered, as well as previously known, colemanite and ulexite-probertite deposits.

The colemanite deposits discovered in the late 1950s near Kramer Junction are estimated to contain 12 million tons of 17% B_2O_3, 24 million tons of 14% B_2O_3, 47 million tons ot 9% B_2O_3, and 11 million tons of 5% B_2O_3. There are major problems associated with mining these deposits that may preclude their development for the foreseeable future.

•Special Publication 51. State policy for surface mining and reclamation practice, prepared by the California State Mining and Geology Board. Free.

SP 51 contains the complete text of the State Policy for Surface Mining and Reclamation Practice. Section 3505(b) of the State Administrative Code under Title 14, Natural Resources, Division 6 Resources Agency, Chapter 8 Mining and Geology, Subchapter 1 State Mining and Geology Board states "Identification of Mines. The Lead Agency shall identify all operating surface mines within its jurisdiction and notify the operators that reclamation plans must be submitted within a reasonable time, but not exceeding one year from the effective date of these guidelines."

The effective date of the Guidelines was April 28, 1977. By April 28, 1978, reclamation plans for those surface mining operations which did not require a new permit must be submitted for lands mined subsequent to January 1, 1976.

•Map Sheet 27. Geology of the northeast part of the Palos Verdes Hills, Los Angeles County, California, by G. B. Cleveland. $7.00.

MS 27 consists of two sections, scale 1:12,000 on which are delineated geologic features of possible engineering significance within a 12 square miles area in the northeast part of the Palos Verdes Hills. The map is not intended for direct or specific site engineering use. In addition to the major rock units and structural features present in the study area, isolated outcrops of ancient talus deposits, resistant sandstone, shale, limestone and chert in the Monterey Formation, thin beds of tuff, landslides and landslide scraps, artificial cuts, and fossil localities are shown on the map.

•Map Sheet 28. Geology of the west central part of the Mount Wilson 7 1/2" quadrangle, San Gabriel Mountains, Los Angeles County, California, by R. B. Saul. $2.50.

The geology is mapped on a topographic base (scale 1:12,000). Included with the map sheet is a 15-page report summarizing the results of a geologic study of the western half of the Mt. Wilson 7.5 minute quadrangle. The area is underlain by rocks ranging in age from Precambrian (?) to Tertiary. Quaternary deposits consist mainly of landslide debris, with some alluvial deposits also present.

Two extensive fault zones traverse the study area: The Sierra Madre fault, along the south front of the San Gabriel Mountains, and the Mount Lowe fault, 2 miles north-northeast of the Sierra Madre fault.

During the late Quaternary, the San Gabriel Mountains were thrust southward over the San Dimas Formation along the zone of the Sierra Madre fault. In the map area, however, there has been no historic surface displacement on this fault zone.

An earthquake centered in this area and with a magnitude equal to that of the 1971 San Fernando earthquake (6.4) would have a comparable effect on this even more densely urbanized area.

•Map Sheet 35. Kaweah Peaks pluton and its relationship to the age of the Kern Canyon fault, Tulare County, California, by J. L. Burnett. $3.00.

Map Sheet 35 (scale 1:62,500) names and delineates the 80-million year old Kaweah Peaks pluton located in the southern part of the Sierra Nevada batholith along the Kern River Canyon. The quartz monzonite

intrusive consists of a vertical unit that intruded the plane of the Kern Canyon fault and a nearly horizontal unit that forms the summits of Mt. Kaweah and the Kaweah Peaks Ridge located along the Great Western Divide. Evidence gathered in the study suggests the Kern Canyon fault formed during Late Cretaceous time or before and ceased to be active at the surface some time before late Pliocene time.

•Map Sheet 36. Geology of the Southern Mother Lode, Tuolumne and Mariposa Counties, California, by J. R. Evans and O. E. Bowen, $3.00.

MS 36 (scale 1:24,000) covers an elongate area of approximately 50 square miles along the southern Mother Lode fault zone in the area of Coulterville, California. Dikes, altered rocks, and vein exposures along the fault zone are colored. Mines, shafts, adits, prospect pits, quarries, and open cut locations are shown.

The geologic summary describes the bedrock units, nature of metamorphism, altered rocks and veins, dikes and surficial deposits. Also discussed is the Mother Lode fault zone, serpentinization, and the geologic history of the southern Moter Lode area.

•San Jose Sheet, Bouguer gravity map of California, scale 1:250,000, by S. L. Robbins, H. W. Oliver, and K. K. Holden.

Gravity contours are printed over a geologic map (scale 1:250,000) with faults and geologic contacts subdued. A text, covering data collection, geologic setting, and major gravity anomalies, and list of references is included with each map.

The gravity data are reduced to complete Bouguer anomalies that include terrain and curvature corrections to a distance of 166.7 km for each station for an assumed density of 2.67 grams per cubic cen for rocks above sea level. The anomalies are contoured at a 5-milligal interval.

•Geologic map of Point Reyes Peninsula, Marin County, California, by Alan J. Galloway. $2.00.

The geology of Point Reyes Peninsula is shown on topographic base (scale 1:48,000).

b) Publications Reprinted

Bulletin 193. Gold District of California. $6.50.

Economic Mineral Map-8. Gold Districts of California. $1.50.

Special Report 118. San Andreas fault in southern California. $4.00. (Plate 1 of 1 of first printing is obsolete, see Geologic Data Map No. 1 for pertinent fault data).

Special Report 123. Character and recency of faulting, San Diego Metropolitan Area. $4.00.

Special Publication 35. Preliminary report and geologic guide to Franciscan Melanges of the Moro Bay-San Simeon area. $2.00.

Special Publication 39. Earthquakes: be prepared. $0.35.

Special Publication 40. Legal guide for California prospectors and miners. $1.00. By Charles L. Gilmore and Richard M. Stewart. With CDMG Note Number 50, Surface mining and reclamation act of 1975. Also amended mining regulations reprinted from CALIFORNIA GEOLOGY 1974 inside front cover.

Special Publication 42. Fault hazard zones in California. Revised January 1976. With Supplement to January 1976 Edition of Special Publication 42 inserted inside front cover. $1.00.

Special Publication 48. Second report on the Strong-Motion Instrumentation Program. $1.00.

Map Sheet 14. Geology of the Furnace Creek Borate area, Death Valley, Inyo County, California. $2.00.

The following reprints of the GEOLOGIC MAP OF CALIFORNIA, Scale 1:250,000 have been released:

San Jose sheet	
Needles sheet	
Colored folded	$2.50
Colored flat	$2.50
Uncolored, flat only	$1.50

c) CALIFORNIA GEOLOGY

Major articles published in the monthly magazine were:

Landslides, the descent of man.
A California Jokulhlaup.
Palmdale bulge.
Rock types of the Franciscan Formation, Coyote Hills, Alameda County, California.
Trench shoring.
Geologic features of Death Valley.
Structural features of the Salton trough as seen from Skylab.
Place of coal in the total energy needs of the United States.
History of coal in California.
Earthquake predictions: Potential blessing.
Lime industry in California.
Landslide potential in the United States.
Coastal Zone Geology near Mendocino, California.
Seismic safety for California dams.
Geologic and engineering geology guidelines City of San Jose.
Lookout - City on the Mountain.
Pueblo water rights of the City of Los Angeles.

Economic evaluation of Pine Mountain phosphate deposit, Ventura County, California.
Living in earthquake country - A survey of residents living along the San Andreas fault.
Arcuate faults and grabens in Death Valley, California.
Environmental impact reports.
Microearthquake recording systems.
Coastal Zone Geology near Gualala, California.
Summary of 1975-1976 Legislation.
Gem Pegmatites in San Diego County.
Minerals Dilemma. Mineral production vs Urban - Suburban development.
Crustal movement in the northern Sierra Nevada.
Recent fractures along the northeast margin of the Salton Trough, Imperial County, California.
Glaciers of Mt. Shasta.
Feldspar deposit in the Ord Mountains, San Bernardino County, California.
Earthquake-ground motion records.
Radiocarbon dating of landslides in southern California.
Ballarat - City on the Plain.
Mineral industry of California 1976.
Alquist-Priolo Special studies zones Fault investigation reports.
Economic geology of McCloud limestone South Gray Rocks area, Shasta County, California.
Fossils from the Franciscan Assemblage, Alcatraz Island.
Effective Building Codes.

d) New CDMG Notes

CDMG Note 53. California well sample repository operating procedures and policies.

e) Revised CDMG Notes

CDMG Note 9. CALIFORNIA GEOLOGY order blank.

2. Library

The Division's Library, located at the San Francisco District, is open to the public for reference reading and research use. During the year a new serial record was put into operation, and newly published technical books were ordered as needed. A complete serial list for the Special Libraries Association Union List of Serials and Periodicals was prepared for publication. The American Institute of Mining Engineers, San Francisco section, donated $200.00 to bind old mining books.

3. Museum

The Mineral Museum, located on the second floor of the Ferry Building in San Francisco, open to the general public on weekdays, Monday through Friday, from 8:00 a.m. to 5 p.m., is a mecca not only for geologist and students, but also for tourists due to increased tourism in the general Embarcadero area and the display in the Ferry ticket office. Many specimens in the Museum have been donated by society members and mineral dealers. The display case made available to Bay Area mineral and gem societies on a rotational basis continues to reveal the beauty of minerals and jewelry made from rocks and minerals. The Division was invited to enter a display in the California Federation of Mineralogical Societies and the San Francisco Gem & Mineral Society's annual show. This show was in celebration of the Nation's and San Francisco's Bicentennial year. In keeping with the show theme, our display included the famed Fricot gold nugget, the large gold-in-auriferous-gravel boulder. Besides the display of the state mineral (gold), cinnabar, chromite, and magnesite specimens, and the state rock, (serpentine) were on display.

ADMINISTRATION AND ORGANIZATION

Until September 1976 the Division organization was structured as shown in figure 4. In September the staff member in the position of Geo Data officer was reassigned to the Department of Forestry to perform timbered-land erosion control studies. The duties of this position were delegated to various staff members in the Geo Data Group and the Geo Data Group staff was assigned to the Publications Officer. The responsibilities of the Surface Mining and Reclamation Act were assigned to an Engineering Consultant until a Minerals Officer could be appointed.

The new organization was adopted May 1, 1977 and the structure is shown on figure 5. The Strong Motion Instrumentation Program was renamed the Office of Strong Motion Studies (OSMS) in the new organization (figure 2) and the mine reclamation, safety, and earthquake response coordination responsibilities were assigned to the Executive Assistant of OSMS.

1. DISTRICTS

The Division's program is carried out primarily through three district offices located in Los Angeles, San Francisco and Sacramento. The areas of responsibility of each of these districts is shown in figure 6.

a) LOS ANGELES

The Los Angeles District serves all of southern California; it comprises eleven counties bounded on the north by, and including, the counties of San Luis Obispo, Kern, and Inyo. The District office is

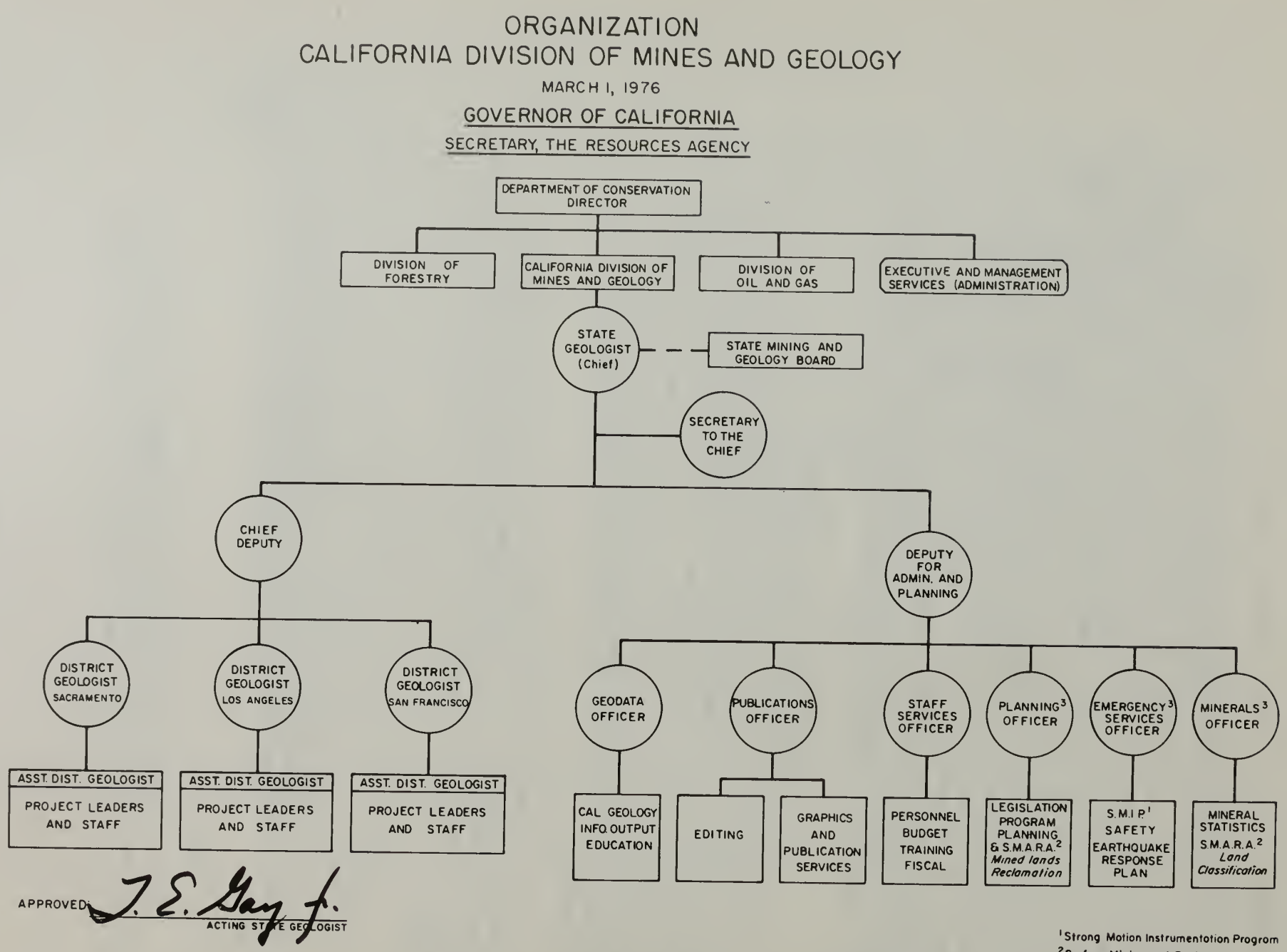


Figure 4. Organization of California Division of Mines and Geology (March 1, 1976).

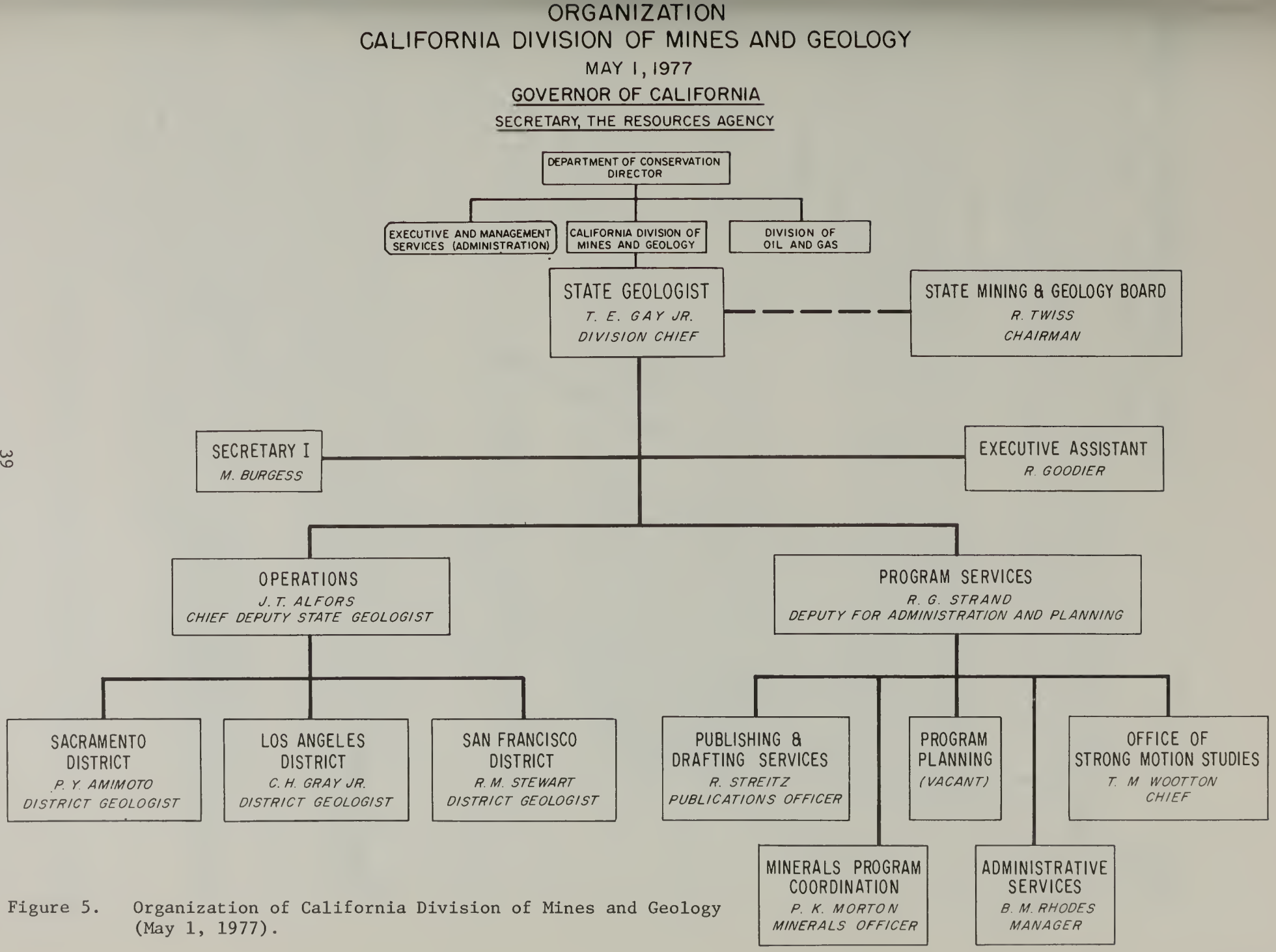


Figure 5. Organization of California Division of Mines and Geology (May 1, 1977).

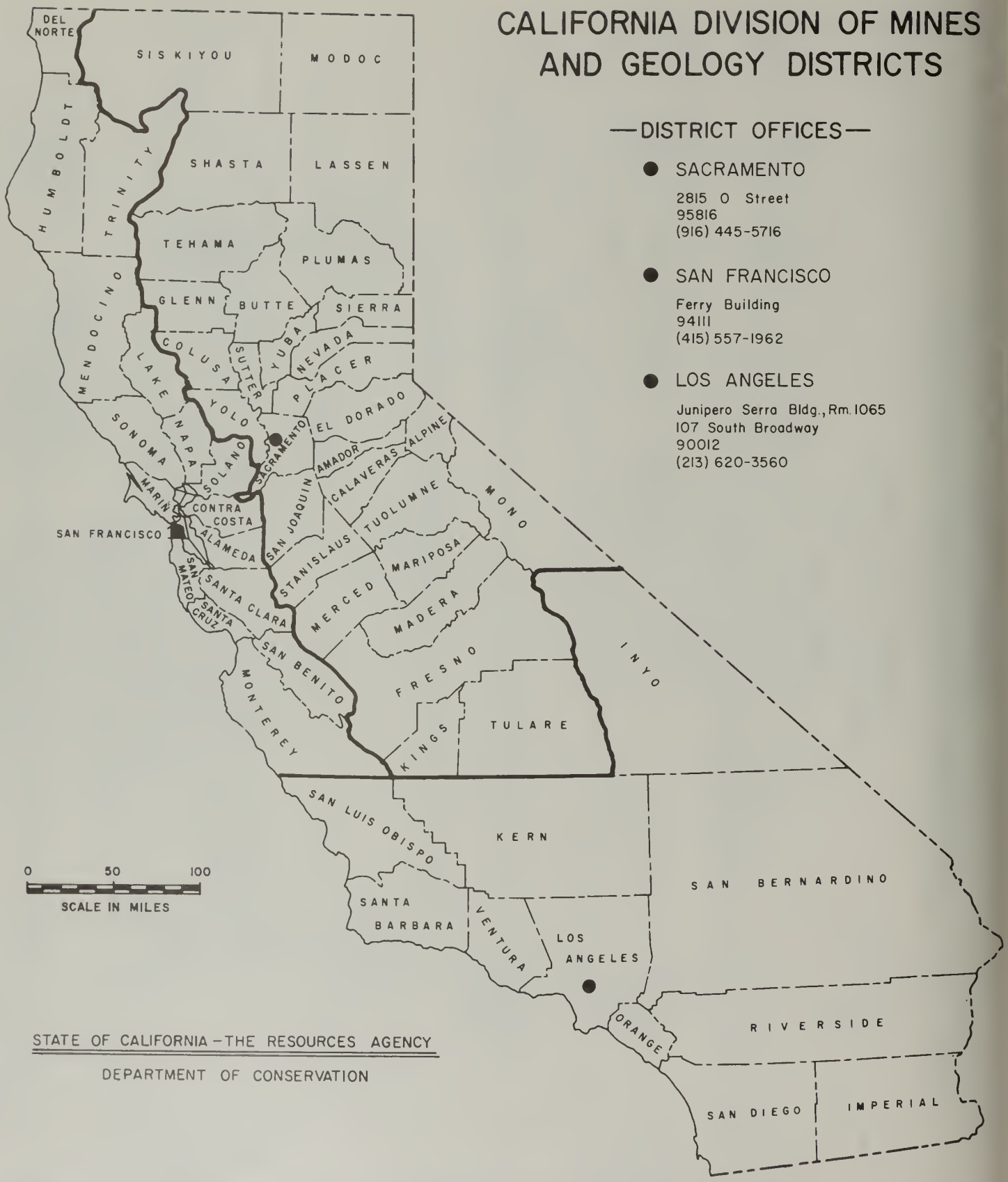


Figure 6. California Division of Mines and Geology, Districts.

located in the Junipero Serra State Building at 107 South Broadway in the Los Angeles Civic Center.

The District staff includes 17 geologists, 1 geologic aid, 1 drafting technician, and 3 secretaries. Four small field offices, are maintained near projects; currently field offices are located in San Diego, San Luis Obispo, Santa Ana, and the UCLA campus. The Los Angeles District maintains a public information center as well as a small technical library.

The bulk of the project work of the District involves cooperative investigations with local counties and the U. S. Geological Survey, and is concerned primarily with geologic hazards and environmental geology as it relates to proper land use. During the current year these investigations have concentrated heavily upon active and potentially active faults. Mineral resources studies were also conducted in the general Los Angeles area.

b) SACRAMENTO

The Sacramento District Office, located at 2815 "O" Street in Sacramento, provides geologic services to thirty counties in central inland and northeastern California. In addition, this District office provides geophysical and seismological services to the entire State.

District efforts have focused on crustal deformation and seismicity with a view toward developing an earthquake-warning system by identifying precursors to damaging earthquakes. Geological work has emphasized mineral resources and the evaluation of environmental considerations in land development.

The Sacramento District staff consists of 7 geologists, 3 geophysicists, 3 seismologists, 2 geologic aids, 2 secretaries, and 1 information clerk.

c) SAN FRANCISCO

The San Francisco District office, which has been housed in the historic Ferry Building since 1896, covers a working territory of seventeen counties in northern and central coastal California. This includes approximately two-thirds of the California seacoast, most of the central and northern Coast Ranges, and much of the very active San Andreas fault and related faults.

Several Division-wide facilities exist in this District office: the geochemical laboratory, which provides analytical and testing support to Division staff; the map room, in which are compiled and prepared various maps such as the Geologic Map of California series; the Division's large and complete technical reference library; and one of the largest mineral museums on the west coast.

Many cooperative projects with various San Francisco Bay area counties and the U. S. Bureau of Mines (USBM) have been undertaken by this office. The Alquist-Priolo Special Studies Zones program also is conducted in this office. The main emphasis is on geologic hazards and seismic safety. Mineral resources activities are also conducted from this office.

The District staff comprises 14 geologists, 2 geochemists, 3 laboratory technicians, 2 geologic aids, 3 draftsmen, 2 librarians, 5 secretaries and clerks, 1 information clerk and 1 janitor.

2. PERSONNEL

Thomas E. Gay, Jr., was appointed State Geologist for a limited term in February 1977 after serving as Acting State Geologist since October 1975. Subsequently, John T. Alfors was appointed Chief Deputy and Rudolph G. Strand was appointed Deputy for Administration and Planning.

Perry Y. Amimoto was appointed Sacramento District Geologist and Thomas M. Wootton was put in charge of the Office of Strong Motion Studies. Robert D. Goodier was appointed Executive Assistant to the Chief.

Permanent Division Staff Members, June 30, 1977

CLASSIFICATION	EMPLOYEE	LOCATION
State Geologist	Thomas E. Gay Jr.	Headquarters
Chief Deputy State Geologist	John F. Alfors	Headquarters
Deputy for Administration and Planning, Supervising Geologist	Rudolph G. Strand	Headquarters
Executive Assistant, Supervising Engineer	Robert D. Goodier	Headquarters 1/
Strong Motion Studies Officer, Senior Geologist	Tom M. Wootton	Headquarters
Minerals Officer, Senior Geologist	Paul K. Morton	Los Angeles
Publications Officer, Senior Geologist	Robert Streitz	Headquarters
Staff Services Officer, Senior Clerk Typist	Beverly M. Rhodes	Headquarters
District Geologist, Supervising Geologist	Cliffton H. Gray, Jr.	Los Angeles
Assistant District Geologist, Senior Geologist	F. Harold Weber, Jr.	Los Angeles
District Geologist Supervising Geologist	Perry Y. Amimoto	Sacramento
Assistant District Geologist, Senior Geologist	C. Forrest Bacon	Sacramento
District Geologist Supervising Geologist	Richard M. Stewart	San Francisco
Assistant District Geologist Senior Geologist	Charles C. Bishop	San Francisco

1/ Assigned to Division from Department of Conservation

Senior Geologist (Geophysics)	Rodger H. Chapman	Sacramento
Senior Geologist	Charles W. Chesterman	San Francisco
Senior Geologist	Earl W. Hart	San Francisco
Senior Geologist	Charles W. Jennings	San Francisco
Senior Geologist	George B. Cleveland	San Luis Obispo
Senior Marine Geologist	Michael P. Kennedy	San Diego
Petroleum Geologist	Edward C. Sprotte	Los Angeles
Associate Geologist	William B. Clark	Headquarters
Associate Geologist	Carl J. Hauge	Headquarters 2/
Associate Geologist	Thomas P. Anderson	Los Angeles
Associate Geologist	Allan G. Barrows	Los Angeles
Associate Geologist	Donald F. Fife	Los Angeles
Associate Geologist	Robert L. Hill	Los Angeles
Associate Geologist	James E. Kahle	Los Angeles
Associate Geologist	Edmund W. Kiessling	Los Angeles
Associate Geologist	Roger C. Martin	Los Angeles
Associate Geologist	Russell V. Miller	Los Angeles
Associate Geologist	Richard B. Saul	Los Angeles
Associate Geologist	Siang S. Tan	Los Angeles
Associate Geologist	John L. Burnett	Sacramento
Associate Geologist	Charles F. Armstrong	San Francisco
Associate Geologist	Michael E. Huffman	San Francisco 2/
Associate Geologist	Frederic R. Kelley	San Francisco
Associate Geologist	Salem J. Rice	San Francisco
Associate Geologist	Melvin C. Stinson	San Francisco
Associate Geochemist, Geochemical Manager	Hasmukhrai H. Majmundar	San Francisco
Associate Geochemist	Glenn A. Borchardt	San Francisco
Associate Geophysicist	John H. Bennett	Sacramento
Associate Geophysicist	Gordon W. Chase	Sacramento
Senior Seismologist	Roger W. Sherburne	Sacramento
Associate Seismologist	Lawrence D. Porter	Sacramento
Associate Seismologist	Tousson R. Toppozada	Sacramento
Associate Geologist	Mary C. Woods	Headquarters
Associate Seismologist	Lalliana Maulchin	Sacramento
Associate Seismologist	Chris Cramer	Sacramento
Assistant Geologist	David J. Beeby	Los Angeles
Assistant Geologist	Drew P. Smith	Los Angeles
Assistant Geologist	Theodore C. Smith	San Francisco
Assistant Geologist	Quintin A. Aune	Sacramento
Assistant Geologist	Ed Leivas	Headquarters
Associate Geologist	John S. Rapp	Sacramento
Assistant Geologist	Ralph C. Loyd	Headquarters
Associate Seismologist	Charles R. Real	Sacramento
Assistant Geologist	Yvor H. Smitter	Sacramento

2/ Special assignment to the Department of Forestry

Assistant Geologist	Gary C. Taylor	Sacramento
Assistant Geologist	Edward J. Bortugno	San Francisco
Assistant Geologist	Richard T. Kilbourne	San Francisco
Assistant Geologist	Michael W. Manson	San Francisco
Assistant Geologist	Trinda B. Ristau	San Francisco
Assistant Geologist	David L. Wagner	San Francisco
Precision Elec. Specialist	Albert G. Guyer	Sacramento
Electronics Technician	Harry P. LaGesse	San Bernardino
Electronics Technician	Marvin M. Huston	Sacramento
Electronics Technician	Charles E. Luzier	Sacramento
Electronics Technician	Thomas McGrady, Jr.	Sacramento
Civil Eng. Tech. II	Milton J. Seaton	Sacramento
Laboratory Technician	Ricarco DeRama	San Francisco
Laboratory Technician	Marcos R. Loza	San Francisco
Laboratory Technician	Charles B. Smith	San Francisco
Geologic Aid	Gordon L. Campbell	Sacramento
Geologic Aid	Ernest C. Durrwachter	Sacramento
Geologic Aid	William Lo	San Francisco
Geologic Aid	George J. Saucedo	San Francisco
Publications Supervisor	R. Merl Smith	Headquarters
Senior Geological Drafting Technician	Richard R. Moar	San Francisco
Geological Drafting Technician	Richard T. Boylan	Headquarters
Geological Drafting Technician	Dorothy Y. Fong	Headquarters
Geological Drafting Technician	Edward L. Foster	Headquarters
Geological Drafting Technician	Jeffrey O. Tambert	Headquarters
Geological Drafting Technician	Elizabeth M. Lindgren	Los Angeles
Geological Drafting Technician	Donald R. Anderson	San Francisco
Geological Drafting Technician	Robert R. Switzer	San Francisco
Graphic Artist	Ronald L. Morgan	Headquarters
Drafting Aide II	Rodney K. Wong	Headquarters
Drafting Aide II	Victor A. Protasov	Los Angeles
Librarian	Angela Brunton	San Francisco
Library Technical Assistant	Marianne Leach	San Francisco
Secretary I	Mary L. Burgess	Headquarters
Senior Stenographer	Suzanne L. Cross	Headquarters
Senior Stenographer	Josephine M. Territo	San Francisco
Editorial Aid	Mindy Lackey	Headquarters
Senior Information Clerk	Eleanor M. Learned	San Francisco
Sernior Clerk-Typist	Wilma B. Ashby	Los Angeles
Senior Clerk-Typist	Gloria Tomei	Sacramento
Senior Account Clerk	Beryl Adrian	Sacramento
Stenographer	Jean E. Holmes	Sacramento
Stenographer	Bonnie Lee	Sacramento
Stenographer	Betty E. Van Den Berg	San Francisco
Stenographer	Delores Fuller	San Francisco
Senior Account Clerk	Venice Huffman	Los Angeles
Clerk-Typist II	Marcy L. Walker	Headquarters
Clerk-Typist II	Sue Torres	Los Angeles
Clerk-Typist II	Dorothy L. Hamilton	San Francisco
Clerk-Typist II	Marianne K. Roja	San Francisco
Janitor	Andrew C. Love	San Francisco

Temporary Employees

The Division has participated in various Federal, State, and locally funded student aid programs throughout the year.

Student Assistants and non-paid Volunteer Government Interns are employed in full or part-time positions during the year.

This program of hiring part-time and seasonal help is an intregal part of the Division's affirmative action and recruitment program. Only a few part-time employees are hired; about 50% of the part-time employees are from minority groups.

Hired

Bonnie Lee	Stenographer
Delores Fuller	Stenographer
Chris Cramer	Associate Seismologist
Marianne Leach	Library Technical Assistant
Laurence D. Porter	Associate Seismologist (?)
Eddie Leivas	Assistant Geologist
Richard T. Kilbourne	Assistant Geologist
Ralph C. Loyd	Assistant Geologist
Mindy Lackey	Editorial Aid
George J. Saucedo	Geologic Aid
Robert D. Goodier	Supervising Engineer*
Victor A. Protasov	Drafting Aide II
Jeane Holmes	Stenographer
Roger C. Martin	Associate Geologist
Lalliana Mualchin	Associate Seismologist
Rodney K. Wong	Drafting Aid II
Thomas McGrady, Jr.	Electronics Technician
Marvin M. Huston	

Promoted

Albert C. Guyer	Precision Electronic Specialist
Michael P. Kennedy	Senior Marine Geologist
Beryl Adrian	Senior Account Clerk
F. Harold Weber, Jr.	Sr. Geol. (Asst. District Geol.)
Milton J. Seaton	Civil Engineer Technician II
Charles F. Armstrong	Associate Geologist
Michael W. Manson	Assistant Geologist
Thomas P. Anderson	Associate Geologist
Roger W. Sherburne	Senior Seismologist
Donald L. Fife	Associate Geologist
Charles R. Real	Associate Seismologist
Robert L. Hill	Associate Geologist

*Assigned to the Division from the Department of Conservation

Siang S. Tan	Associate Geologist
Russell V. Miller	Associate Geologist
Mary C. Woods	Associate Geologist
Suzanne L. Cross	Senior Stenographer
John S. Rapp	Associate Geologist

Transferred

Dave Gilb	Staff Services Analyst
Leslie H. Pollock	Clerk-Typist II
Paul K. Morton	Senior Geologist
Michael W. Manson	Assistant Geologist

Separated

James R. Evans	Senior Geologist
Mary R. Hill	Senior Geologist
Michael J. Hardin	Library Technical Assistant
John W. Williams	Associate Geologist
Willima Wells	Associate Geophysicist
Jay H. Power	Assistant Geologist
Duane A. McClure	Geological Aid (Retired)
Vivian Muston	Geological Drafting Technician (Retired)
Leslie Morrow	Civil Eng. Tech.
Judith A. Toole	Library Technical Assistant
Marilyn Dayton	Editorial Aid
Marcy L. Walker	Clerk-Typist II
Laura B. Carter	Stenographer

Deceased

Dorris P. Campbell	Sr. Stenographer

3. INTERAGENCY ACTIVITIES

In carrying out its program, the Division participated in a number of interagency activities. Some of the interagency groups in which the Division was involved during the fiscal year are:

Advisory Board to Strong Motion Instrumentation Program
Advisory Committee on Geographic Names
Advisory Group to Joint Legislative Committee on Seismic Safety
Archaeological Study Task Force
Building Safety Board (Department of Health) - Geotechnical Subcommittee
California Coastal Commission
Geothermal Resources Board
Governor's Earthquake Council
Governor's Interagency Earthquake Committee
Land Use Study Committee (Office of Planning and Research)
Monterey Basin Pilot Monitoring Project Committee
Nuclear Regulatory Commission
Power Plant Siting Committee
Resources Agency Task Force on Timber Harvest Plan Review
Seismic Safety Commission - Hospital Act Committee
State Solid Waste Management Board
State Solid Waste Management and Resources Recovery Advisory Council
Technical Advisory Committee to Geothermal Resources Board
Technical Advisory Committee to San Francisco Bay Conservation and Development Commission

4. BUDGET SUMMARY

Expenditures*		
Personal Services		$2,328,071
Operating Expenses		785,759
General Expense	$152,815	
Printing	171,956	
Communications	51,544	
Travel Out of State	4,364	
Motor Vehicle Operations	60,706	
Professional/Consulting Service	84,488	
Pro Rata Costs	8,049	
Facilities Operating and Maintenance	613	
Rent	210,755	
Blueprinting	22,156	
Out Service Training	3,849	
In Service Training	826	
Electronic Data Processing	13,638	
Equipment		319,814
Replacement	452	
Additional	319,362	
California Institute of Technology		
Network Contract		57,000
Total Expenditures		3,490,644
Less		1,251,932
Reimbursements	607,956	
Strong Motion Instrumentation Program Fund	621,176	
California Water Fund	11,400	
State Highway Account, State Transportation Fund	11,400	
Total General Fund Expenditures		$2,238,712

* Based on information available June 30, 1977

5. STATE MINING AND GEOLOGY BOARD

The State Mining and Geology Board is a nine-member board appointed by the Governor to serve a four-year term. The Governor designates the chairman, who shall hold such office at the Governor's pleasure. The vice-chairman is elected annually. The Board began the fiscal year with eight members; the ninth member joined the board in October 1976.

The Board's responsibilities, as stated in the Public Resources Code, are as follows:

"The Board shall represent the state's interest in the development, utilization, and conservation of the mineral resources of the state and the reclamation of mined lands, as provided by law, and federal matters pertaining to mining, and shall determine, establish, and maintain an adequate surface mining and reclamation policy. The Board shall also represent the state's interest in the development of geological information necessary to the understanding and utilization of the state's terrain, and information pertaining to earthquake and other geologic hazards. General policies for the division shall be determined by the Board.

"The Board shall also serve as a policy and appeals board for the purposes of the Alquist-Priolo Special Studies Zones Act (Chapter 7.5, Division 2, Public Resources Code).

"On or before December 31 of each year, the Board shall submit to the Governor and the Legislature recommendations regarding needed research projects relating to the state's terrain, mineral resources, mining, the reclamation of mined lands, and earthquakes and other geologic hazards.

"The Board may provide for a statewide program of research regarding the technical phases of reclaining mined lands which may be delegated to it by law and may accept funds from the United States or from any person to aid in carrying out the provisions of this section. The Board may conduct such a program independently or by contract or in cooperation with any person, public or private organization, federal agency, or state agency, including any political subdivision of the state.

"The Board shall provide for a public information program on matters involving the state's terrain, mineral resources, mining, the reclamation of mined lands, and earthquakes and other geologic hazards."

The State Geologist, who serves as Chief of the Division, is appointed under provision of the State Civil Service Act by the Director of the Department of Conservation upon nomination by the Board.

During the fiscal year 1976-77 the Board met as follows:

July 20	San Francisco	Feb. 24 & 25	San Diego
Sept. 22	Sacramento	March 18	San Francisco
Oct. 26 & 27	Los Angeles	April 22	Sacramento
Nov. 16	Sacramento	May 27	Sacramento
Dec. 21	Sacramento	June 24	Bishop
Jan. 21	Sacramento		

a) Major Board Actions, Fiscal Year 1976-77

Held a public hearing on state policy for Surface Mining and Reclamation Practice and adopted such a policy.

Submitted an annual report to the Governor and the Legislature entitled "Recommendation for Program Emphasis in the California Division of Mines and Geology"

Nominated Thomas E. Gay, Jr. to a limited appointment as State Geologist.

Held a public hearing on guidelines for classification of mineral lands and adopted the guidelines.

Petitioned the Governor of California to join with governors of other western states to request that the U. S. Secretary of Interior temporarily suspend assessment work required under the 1872 mining law due to severe fire hazard created by the drought.

b) Membership: State Mining and Geology Board

BOARD MEMBER	CURRENT TERM (Expires January 15)	FIRST APPOINTED	SPECIALTY (per Sec. 662, PRC)
ROBERT H. TWISS* (CHAIRMAN 1/77-7/77) 1200 Masonic Street Berkeley, CA 94706	1976-1978	1976	Landscape architect: soil conservation or revegetation (Univ. of Calif. Coll. of Environmental Design Dept. of Landscape Architecture)
PRISCILLA C. GREW** (CHAIRPERSON 7/76-1/77) Assistant Research Geologist Institute of Geophysics and Planetary Physics University of California, L.A. Los Angeles, CA 90024	1976-1978	1976	Nonspecialized experience (UCLA)

ALCIDES S. FREITAS 8409 Purdue Court Sacramento, CA 95826	1976-1977	1976	Environmental protection (Sacramento County Office of Environmental Management)
WILLARD P. FULLER, JR. P.O. Box 694 San Andreas, CA 95249	1976-1977	1976	Mining engineer: mining minerals in California (Calaveras Cement Co.)
ARTHUR GRANTZ (VICE CHAIRPERSON) 380 Olive Street Menlo Park, CA 94025	1976-1979	1976	Mineral resource (U.S. Geological Survey)
RETURN F. MOORE President, Moore & Taber 4530 East La Palma Avenue Anaheim, CA 92807	1976-1980	1976	Registered civil engineer: soil engineering (Moore & Taber)
DOUGLAS W. SPRAGUE 6738 Vanport Avenue Whittier, CA 90606	1976-1977	1976	Registerd geologist: mining geology (Pryor-Giggey Co. Santa Fe Springs)
TA-LIANG TENG Professor of Geophysics Department of Geological Sciences University of Southern California University Park Los Angeles, CA 90007	1976-1980	1976	Registered geophysicist: Seismology (USC)
ELEANOR J. YOUNG 123 Hoover Road Santa Cruz, CA 95065	1976-1979	1976	Local government representative: urban planning (Santa Clara Transportation Section)

Vacant Position 1/77-7/77

* Designated Chairman by the Governor February 1977.

** Resigned from Board to become Director of the Department of Conservation on February 1, 1977.

6. STATUTORY AUTHORITY

The Division operates under the authorities set forth in Chapter 2 of Division 1 and Chapters 1 and 2 of Division 2 of the Public Resources Code. The significant sections are summarized here:

Sections	Substance of Law
601, 607	Establishes Department of Conservation in The Resources Agency and Division of Mines and Geology and three other Divisions in Department of Conservation.
660-667	Establishes State Mining and Geology Board and its responsibilities.
680	Establishes State Geologist as Chief of Division.
2201	State Geologist shall employ geologists and qualified specialists to do Division's work.
2203	State Geologist shall submit an annual report, including review of measures taken to counter geologic hazards, and review of economic utilization and conservation of State's mineral resources.
2204	State Geologist may receive and manage gifts on behalf of State.
2205	State Geologist may: Study mineral resources, mineral industries, and geology of the state; collect mineral statistics; Collect geological and mineralogical specimens and models to constitute Division's exhibits; Provide technical library to be Division's library; Maintain, in effect, a bureau of information on the State's mineral industries; Conduct studies of geologic hazards in urban areas, including activities under cooperative agreements; Maintain a laboratory to perform physical and chemical tests and analyses; Issue reports and maps on the geology of the State and the statistics and technology of the State's mineral industries.
2207	State Geologist shall compile and publish statistical bulletins to show totals of minerals produced, annually.
2622	State Geologist shall delineate Special Studies Zones to encompass potentially and recently active faults (Alquist-Priolo Act).
2650	State Geologist shall carry out State Mining and Minerals Policy.
2700	State Geologist shall conduct the Strong-Motion Instrumentation Program throughout the State.

7. RECENT LEGISLATION

Legislative measures enacted into law during 1976-1977 of concern to the Division are as follows:

AB400, McCarthy. Chapter 1440 (1976) AB1277, Smith. Chapter 1330 (1976) AB2948, Hart. Chapter 1331 (1976)	These three bills create the California Coastal Act of 1976. Establishes coastal management goals, policies and Coastal and Regional Commissions to carry out the program.
AB3590, Kapiloff. Chapter 958 (1976)	Creates a Geothermal Task Force to study all aspects of geothermal resources in California and report to Legislature and Governor by July 1, 1977.
AB3884, Greene. Chapter 557 (1976)	Limits geologic and soil studies for school sites to areas designated as geologically hazardous in the seismic safety element of the general plan.
AB4018, Maddy. Chapter 1280 (1976)	Limits penalty for accidental appropriation of minerals from State owned lands.
AB4447, Burke. Chapter 942 (1976)	Specifies royalty for mineral deposits leased from State Lands Commission.
SB78, Nejedly. Chapter 1300 (1976)	Gives the Division of Forestry departmental status. The Divisions of Mines and Geology, Oil and Gas, and Resource Conservation will remain in the Department of Conservation. SB 78 was signed by the Governor on 28 September 1976, and will become effective 1 January 1977.
SB1845, Alquist. Chapter 1243 (1976)	Abolishes the Geologic Hazards Technical Advisory Committee established to advise the Alquist-Priolo Special Studies Zones program, and the Strong Motion Instrumentation Program Advisory Board established to advise the Strong Motion Instrumentation program. The bill

	provides that the Seismic Safety Commission assume the advisory functions for these programs. SB 1845 was signed by the Governor 22 September 1976. (Effective 1 January 1977).
SB1950, Alquist. Chapter 1267 (1976)	Provides that public entities are not liable for actions taken or not taken in response to an earthquake production. (Effective 9/17/77).
SB2126, Nejedly. Chapter 450 (1976)	Exempts any school camp building which does not occupy the same site as any school in the district from Field Act requirements. The bill became law without the Governor's signature 10 July 1976. (Effective 1 January 1977).
Senate Joint Resolution 53, Berryhill. Chapter 123 (1976)	Requests that the California Division of Mines and Geology, the U.S. Geological Survey, and the U.S. Bureau of Mines intensify their efforts to catalog mineral resources of critical importance to the future economy of California which are located within, or adjacent to, urban areas. It also requests that CDMG make demand projections for critical minerals; and that local governments protect critical minerals, ensure that mining is conducted in a proper manner, and that the mined land is rehabilitated. (Effective 30 August 1976).

All chapters became effective January 1, 1977 unless otherwise noted.

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